THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXXII. No. 1844.] LONDON, SEPTEMBER 13, 1898. [50TH YEAR. PRICE 6d.

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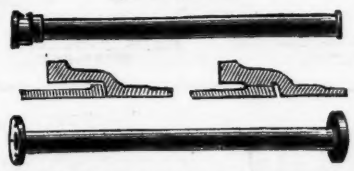

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Fig. 596. "CORNISH" STEAM-PUMP FOR BOILER FEEDING, &c.

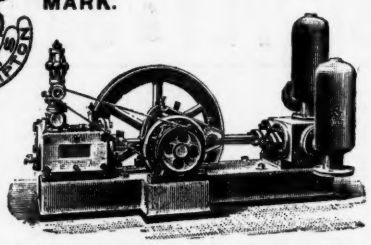

Fig. 685. "RELIABLE" STEAM-PUMP FOR TAR AND THICK FLUIDS.

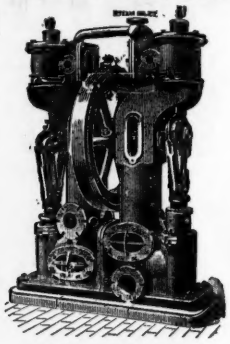

Fig. 712 "DOUBLE-RAM" STEAM-PUMP.

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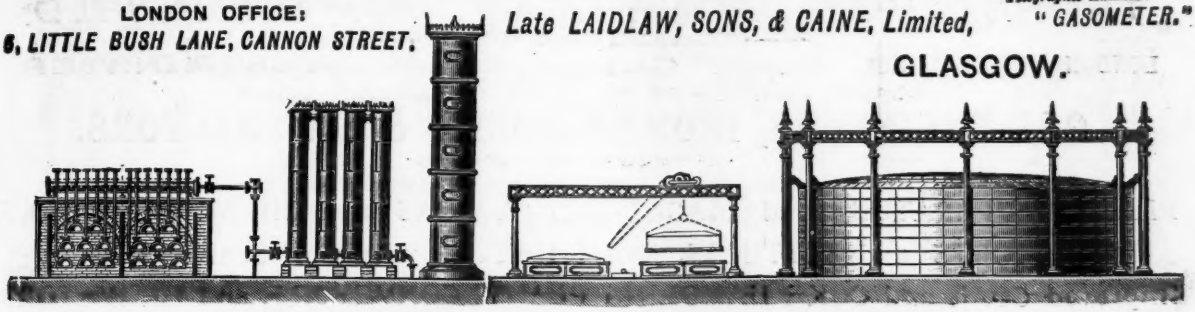

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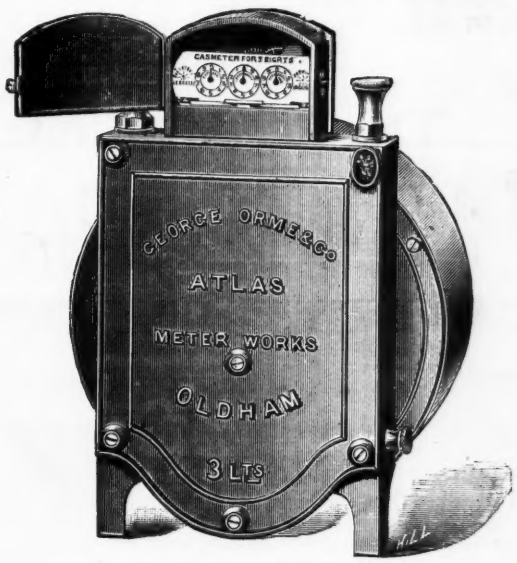

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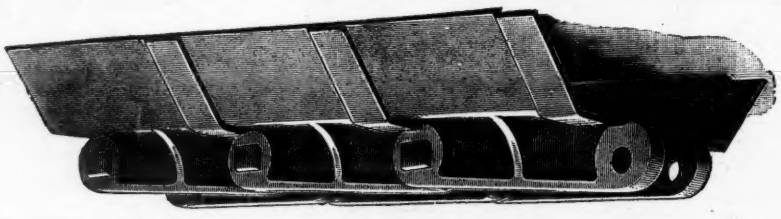

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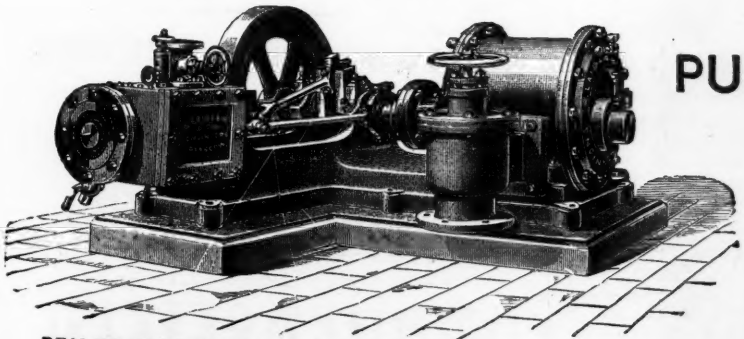

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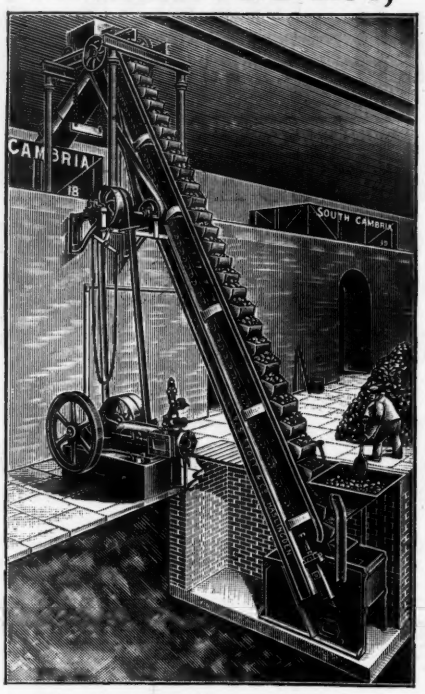

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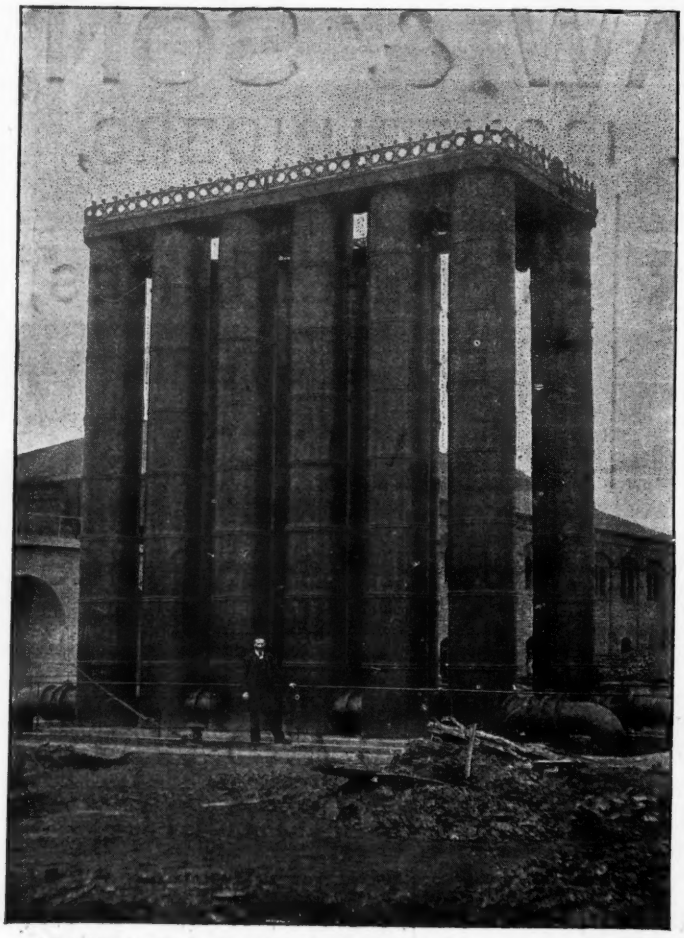

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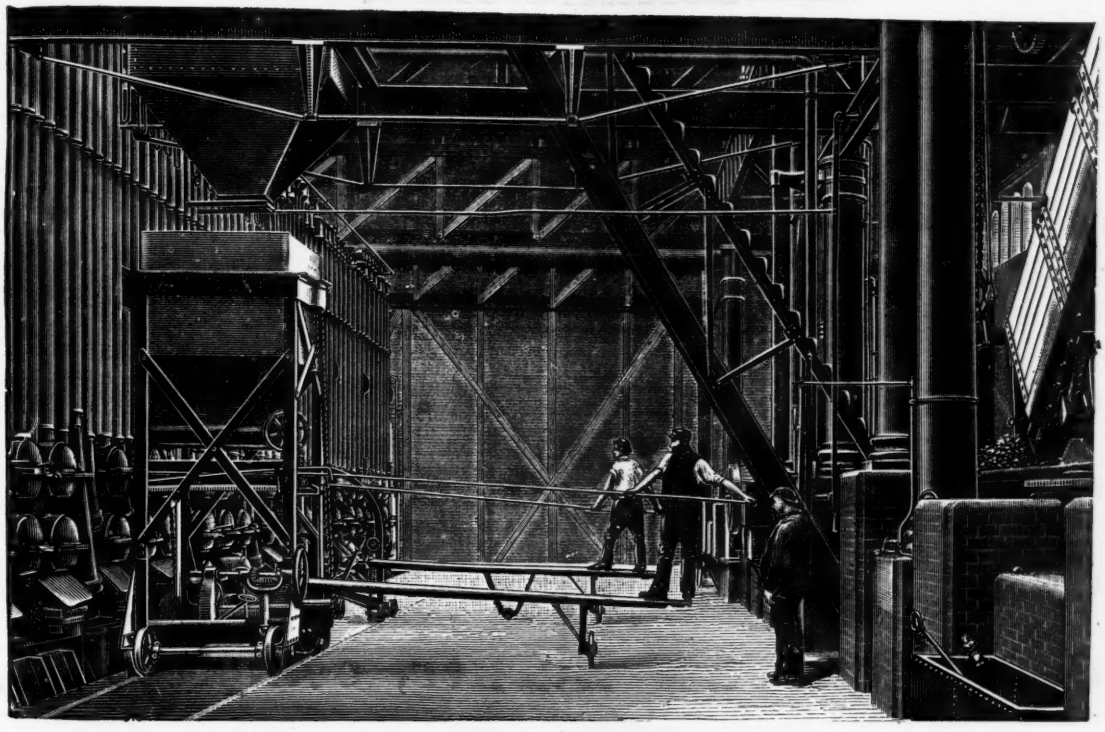

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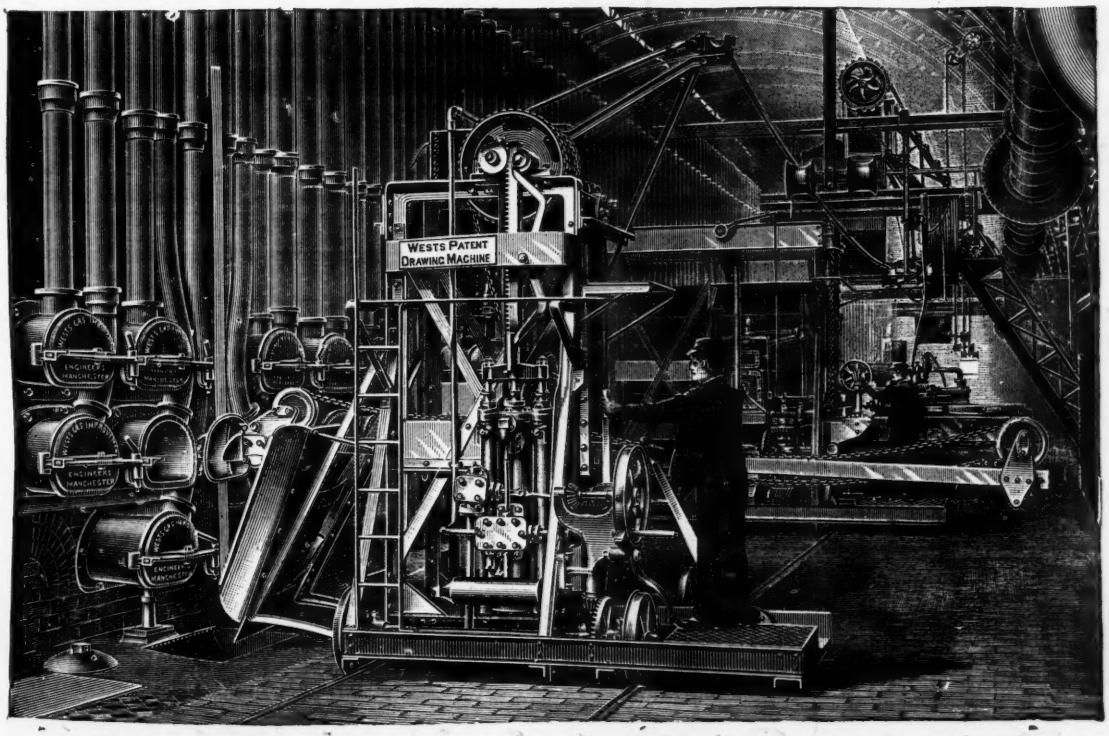

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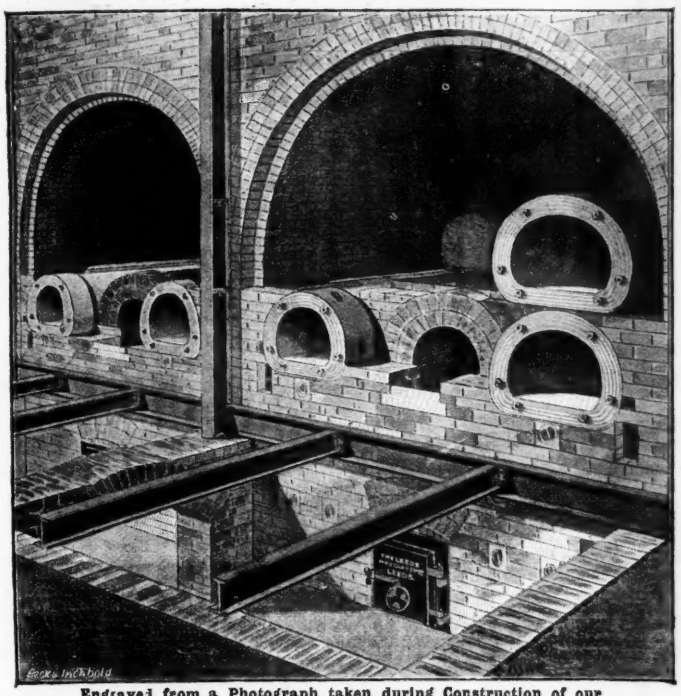

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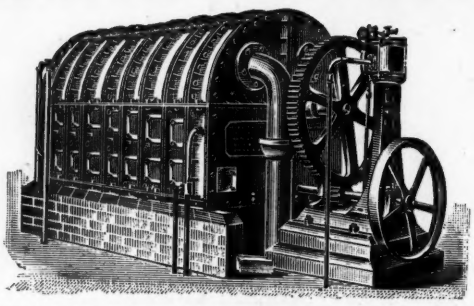

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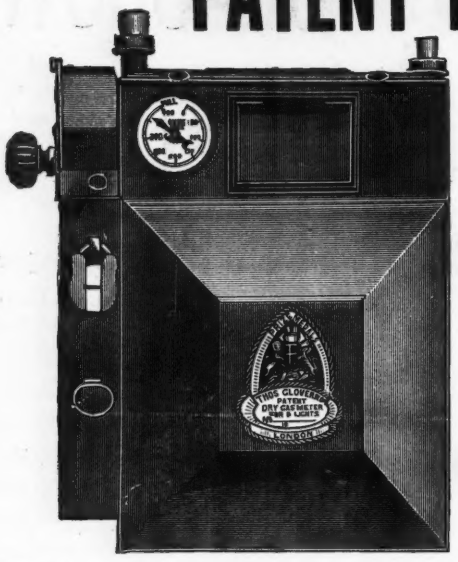

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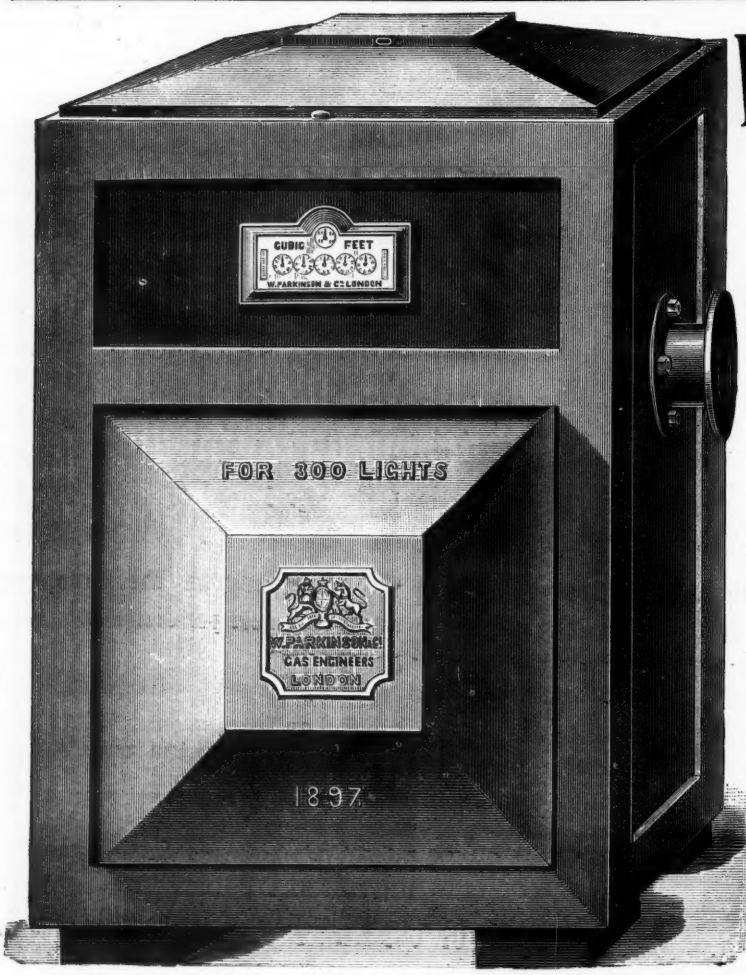

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TO CORRESPONDENTS.

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EDITORIAL NOTES.

Sir W. Crookes on the Need of the Age.

As though to demonstrate the omniscience of a modern learned man, the President of the British Association, Sir William Crookes, took as the first subject of his Inaugural Address the problem of the future food supply of the world—a question that does not fall naturally within the limits of those departments of science in which he has made his world-wide reputation. Before opening up his address, the President offered a remark concerning the character of these compositions, which bears out what we have repeatedly advanced in this regard. He said that "formerly the President unrolled to the meeting a panorama "of the year's progress in physical and biological sciences. "To-day the President usually restricts himself to speciali- "ties connected with his own work, or deals with ques- "tions which for the time are uppermost." Sir W. Crookes allowed it to be understood that he did not intend to follow the old fashion in this respect; and then he forthwith plunged into discussion of the question which, as we have already observed, was no speciality of his, and as to which public interest can hardly be said to have been keenly aroused—the question of the bread supply of the population of these islands. It is these charming little bits of illogicality manifested by learned pundits that show the rest of mankind (who, we know from a very high authority, are "mostly fools") that these eminent ones are human after all. They are also human in another respect, when they happen to occupy the proud position of President of the British Association—they dearly like to make a "sensation." Sir W. Crookes is not the man to misunderstand or lose the benefit of his opportunity. Accordingly he first set himself to make the flesh of his hearers creep, by announcing that within a measurable period the world will not have enough to eat; and then he sought to allay the fear that he had created, by exhibiting Science as a beneficent fairy who is to stand between humanity and the Demon of Hunger.

There was just a little touch of exaggeration in Sir W. Crookes's picture of a world providing itself with more mouths than with food to fill them. The "red fire" of the opening scenes of pantomime was fully in evidence. The year 1931 is the critical period at which, according to Sir W. Crookes, the world of consumers will get beforehand with the world of producers of wheat, unless the latter can effect much more than the traditional service of making two ears of corn grow where one grew before. This can be done only through the application of science to the case of the agriculturist. Wheat needs nitrogen; and this can be given to the crop in various forms. The gas manufacturer may prick up his ears at this announcement, and look for some recommendation of the nitrogenous manure—sulphate of ammonia—in which he is more particularly interested. But he will be disappointed. Sir W. Crookes is well aware that "the distillation of coal "in the process of gas making yields a certain amount of "its nitrogen in the form of ammonia; and this product, "as sulphate of ammonia, is a substance of considerable "commercial value to gas companies." But there is not enough of it to go round. All Europe does not produce more than 400,000 tons of sulphate a year; and "in view "of the unlimited nitrogen required to substantially "increase the world's wheat crop, this slight amount of "coal ammonia is not of much significance." He calls it a "slight amount!" The thanks of manufacturers are due to Sir W. Crookes for relieving them of the last lingering fear of over-production of sulphate. The supply can never be more than insignificant. Then there is the alternative, nitrate of soda. Of this manure, Sir W. Crookes thinks the world will need 12 million tons a year; the present export being 1¼ million tons. It is hardly necessary to remark that, at this rate, the existing deposits will soon be exhausted. Afterwards, if the world is to feed itself, the nitrogen of the atmosphere must be fixed for manurial use at a much cheaper and quicker rate than Hellriegel's microbes can do it.

This fixation of the gas is to be done electrically. As far back as 1892, Sir W. Crookes exhibited to the Royal Society the flame of burning atmospheric nitrogen; thus showing that nitrogen is a combustible gas, under certain conditions. It can be burnt to nitrous and nitric acids, which can be easily recovered. Here we have our fixed nitrogen. But at what price? A Board of Trade unit of

electricity, applied to the burning by induction current of atmospheric nitrogen, will make 74 grammes of nitrate of soda; and therefore 14,000 units would be required to produce a ton of the salt. Even under known conditions, the cost of manufacture need not exceed £5 per ton. And as for the supply of power necessary to make the conversion, there need be no fear. Niagara alone could make all the electricity required without appreciably lessening its value as a spectacle. *Gaudeamus igitur!* Let us eat, drink, and be merry; for when more nitrate of soda is wanted, it will be forthcoming. The world did not know before last Thursday that nitrate of soda was the one thing of which it stood in need. Yet, according to Sir W. Crookes, this is the chief bulwark between the Caucasian race and other races of meaner fibre who can get through life upon a diet of bananas, or millet, or rice. With plenty of nitrate of soda, all that western civilization stands for will continue to progress; without it, all will perish. There is, as we have remarked, a grotesque tinge about this reduction of the way of progressive Humanity, ever toiling towards the stars, to a question of saltpetre; but such is the penalty paid for his "sensation" by the man of science.

The point has not been overlooked. The newspapers have already been poking fun at Sir W. Crookes for trying to frighten people without sufficient cause. If all the earth wants is more fertilizers, and these are to be had, so to speak, by turning a handle at Niagara or somewhere else as soon as the market price offers sufficient inducement, why all this pother? Of a truth, the world has been treated to so many of these scientific vaticinations of what is to happen when such-and-such a geometrical progression has realized itself, that it has become more than a little sceptical of all such exercises. They may be correct, if nothing has been overlooked, and the conclusion has been properly drawn from sufficient and pertinent premises. But this is precisely where the invalidating factor, or the suspicion of it, creeps in. It is quite true that, if a few cod's roes were to hatch completely, the ocean would not have room for any other fish; but they never do. With regard to the infinitely delicate and highly developed ramifications of economic interests, adjustments of supply and demand are made with an exactitude which justifies some forecasts and makes nonsense of others. Sir W. Crookes has enrolled himself in the band of prophets which includes Malthus and Jevons. It is a worthy eminence.

The Waverley Association Meeting.

THE meeting of the Waverley Gas Managers' Association at Duns last Thursday was as successful a gathering as could be expected in a body of managers of small works such as are the bulk of the members of the Association. Of course, much that was said at it was of the nature of "small beer" to those who are accustomed to deal with retorts by the hundred, and with cubic feet by hundreds of millions; but no one seeks to despise the day of small things. On the principle of every soldier carrying the Marshal's bâton in his knapsack, it is feasible to imagine that some of the managers who are to-day struggling with elementary problems in small and isolated works, may rise to be leaders in their walk of life. There is a special reason, however, why the gas managers in the Waverley district should be encouraged to uphold their organization —that is, the antiquity of the body. There may not yet be altogether unanimity as to the claim of the Waverley to be the parent of all Gas Associations; but admittedly it was one of the very first. Like many other questions, time, and a little research, may solve this one. A valuable contribution towards this end was made by Mr. Adamson, of Airdrie, at the dinner after the meeting. Mr. Adamson was at the formation of the Waverley Association; and his testimony is unimpeachable. But, apart from this subject, it will be somewhat of a revelation to many to learn that the idea of gas managers associating themselves together was not suggested for the purpose of mutual help in matters technical, as is now the principal object of such bodies, but by the necessity which was then felt by managers, of protecting themselves against the devastating sweep of the notorious Flintoff. In this view Associations of Gas Managers present another example, of which there are many, of a body being created for one object and developing into something higher and better.

The Cause of the Weakness of Trade Unions.

AMONG the qualifications of success as a Trades Union representative, the power of unlimited make-believe, and unspoilt by any touch of humour or sense of the ridiculous, must take a high place. Otherwise it would be impossible for these grown men to go on playing at the game of passing portentous resolutions which they know to be futile. A favourite resolution at Trade Union Congresses, such as that which recently met at Bristol, is one approving of the federation of Trade Unions as a means of enabling society men to "dictate their own terms as to wages, hours, and "conditions of labour." These are the words with which the President of the congress commended the cause of federation to his audience. It never seems to have struck him or anybody else that there is no bargain when one side has all its own way and the other is helpless. The gentlemen assembled at Bristol in the name of Labour would have raised a fine "howl of deprecation" if Sir W. Lewis, or any other representative employer, had publicly announced his intention of doing by the men what they calmly proposed to effect by realizing their fond dream of federation of all the Unions. The truth is that in all bargains, whatever the subject, each party gets what it can, not what it would; and that all bargains in trade and industry are made under the pressure of outside influences not within the control of either party. Not all the organization or federation of employers or employed that could possibly be engineered by any known or unknown leaders would serve to neutralize the most powerful of the causes of profit and loss in trade. There are professional trade unionists who know this and a good many other things apparently ignored by the majority of their colleagues. Prominent among these is Mr. Knight, the able Secretary of the Boiler Makers, who was put up to speak at Bristol respecting the work of the Special Committee appointed by last year's congress to collect information with a view to framing a federation scheme. Mr. Knight candidly confessed that the labour of this Committee had so far been without fruit. He hinted that the true reason for the failure is the weakness of the individual Trade Unions. What is the good of talking about the federation of Trade Unions, so long as these only embrace in their membership a minority of the workpeople engaged in these particular occupations? This is the question. Trade unionism will never be made strong in the land, says this terribly outspoken Boilermaker, by holding congresses and talking about Socialism and Collectivism and all the rest of it as being the natural and the necessary outcome of any such "movement." Get your men into line first, so that the total number of possible "blacklegs" becomes a negligible quantity; and then you will have a strong Union. Then get a number of such Unions to act in common; and they will be a force for employers and the public to reckon with. It is not the power of the masters that the cause of Unionism has to fear; but the folly of the leaders and spokesmen, who play ducks and drakes with the funds entrusted to them, and otherwise act so that it is an open question whether it is worth a good man's while to be in the Society or not. It is hardly to be wondered at that the platform performers who represent political trade unionism before the world do not like Mr. Knight; he is too old-fashioned for them. But the members of his own Society know what they owe to the man who, almost alone of Trade Union officials, was never known to be "spoiling for a "fight" as soon as a few pounds had accumulated in the Society money-box.

Belfast Corporation Finance.

SOME members of the Belfast Corporation are exercised in mind because the Gas Committee proposed to pay for their last year's extensions out of revenue. The matter was discussed at the last monthly meeting of the Corporation, when Alderman Dempsey challenged the policy of the Committee in this regard, declaring that it would have been better to have reduced the price of gas instead. Another speaker objected that no member of the Corporation would have done the same thing in his own private business. There is an answer to this argument; but it was not needed. The Town Clerk showed himself a worthy successor to the long line of legal authorities who have demonstrated, not only in Ireland, that, when there is no statutory authority for the doing of a necessary thing, the Act can be dispensed with and the thing done very satisfactorily without it—at any rate, for the time being. On this occasion the Town Clerk intimated that, the borrowing powers of the Corporation for gas-works purposes being virtually exhausted, the Gas Committee had

no money beside what was in the till. To the observation that an Act might be obtained, the reply was that this would be for the future, whereas the Committee wanted the cash to spend. Of course, if it were a Gas Company that did this thing, the local authority would want to know the reason why, and make all manner of most unpleasant remarks about it. Being a Corporation, Belfast is in matters financial a law unto itself—always, of course, for the time being.

The Decadence of the Small Electric Lighting Industry.

It has been argued, and not without reason, that the only way for municipal electric lighting to beat gas is to sell current at a cheaper rate than the equivalent gas light. It is, of course, easy to formulate a grand generality of this character; but it is another matter to present it acceptably in pounds, shillings, and pence. When it comes to stating the equivalent of gas in the price of the unit, the most surprising discrepancies appear in the rating of the different light sources. To take the fancy performance of the most improved incandescent electric lamp and compare it with the duty, or the neglect of it, exhibited by the commonest of flat-flame gas-burners, is an old trick that continues to work as satisfactorily for one side as the somewhat older "confidence trick" of police-court renown. Indications are not lacking, however, that the heavy, continuous pressure of the competition of the incandescent gas-burner is telling surely upon many a central station electric lighting speculation. It is pretty well understood, although not generally expressed, that when the new incandescent gas-burners get established in the market, more than one electric lighting company will discontinue business. Of course, this statement will be hotly denied by the electrical press; but it is true, nevertheless. All the efforts of the "Free Wiring" companies to stem the tide will then be unavailing; because the amount of the annual bills cannot be disguised—if indeed it is not really increased by the deferred payment system. And the same may be said of various eccentric systems of charging for current. Local authorities will not feel the pinch for a time; and there will always be a certain amount of electric lighting in demand in large centres of population. But the "small fry"—the little electric lighting companies that carry on business by the aid of a big mortgage and the touching allegiance of the local news sheet—are doomed. Some of them feel it already; but others will succumb after more or less protracted agonies. It is their common experience that when the first period of expansion has come to an end—when customers no longer clamour to be connected to the mains, and loudly abuse the electric lighting people for their dilatoriness in doing this work—the stage of decadence appears. The high-water mark once reached, the tide recedes with alarming precipitancy. One big consumer after another grows tired of the costly little lamps with filaments that glow like newly burnt-out matches, the while his neighbour and rival makes a blaze with incandescent gas-burners; and so the "rot" sets in. There is no stopping it. If the local authority can be prevailed upon to buy up the concern, well and good. The ratepayers will stand almost anything. But yet there are limits even to this process; and these are already in sight in several districts.

WATER AND SANITARY AFFAIRS.

Publication has been given, very opportunely, to the general conclusions contained in the report addressed to the London County Council by Sir B. Baker and Mr. G. F. Deacon, who were instructed to advise the Council upon the whole scheme for a supply of water from Wales. These two eminent Engineers repeat what has been stated before, that for the next ten or fifteen years the Thames must necessarily remain the chief source of supply for London. Beyond that period it is intimated that, together with the wells and probably the Lea, the Thames will always be maintained as an alternative or contributory source of supply, if for no other reason than the danger of making the Metropolis dependent upon a single source which might be liable to accidental interruption. Coming to a more immediate period, it is remarked that the practical question for decision within the next year or two is whether 12 to 15 years hence the additional supply shall come from the Thames or from Wales. Somewhat in a spirit of self-abnegation it is argued that the personal prejudices and sentiments of the public, rather than the opinions of "engineers, chemists, and accountants," are the most powerful factors in deciding questions of this description, and that therefore it is not necessarily a wise course to "accept the lowest tender and take an inferior "article where water supply is concerned." This curious passage, in a wobbling kind of way, leads up to the conclusion that it would be wise to go to Wales.

It will occur, at least to some people, that if "the per-"sonal prejudices and sentiments of the public" are the most powerful factors in settling this question, the report by Sir B. Baker and Mr. Deacon is somewhat superfluous. Every three years the members of the Council have to catch votes, and on such occasions they will naturally have regard for "the most powerful factors," the exact nature of which they will anxiously seek to ascertain. We may suggest whether sufficient consideration has been given to the principle of "the lowest tender." It will be observed that "accountants" are brushed aside along with engineers and chemists; yet the ratepayers may be expected to have some regard for estimates, if they can be relied upon. A calculation is given on the basis of the figures set forth in the report, that in respect to the Welsh scheme the first 200 million gallons per day would involve an additional expenditure of less than a penny per week for an average household, while for the second instalment of 200 million gallons the Welsh water "would be the cheaper of the "two." But the second instalment is a long way off, unless London is prepared to adopt Wales as the entire source of its supply, against which there is the strongest possible objection, as involving the risk of "accidental "interruption." In the meantime there is an "additional "expenditure" which is made to look very small, but which on closer acquaintance may prove by no means insignificant. There are rival estimates; and it is difficult to perceive the economy of departing from a source of supply close at hand, in order to seek for a substitute 200 miles away. However, the Water Committee have got the report of the advising Engineers, and it is understood that they have postponed the consideration of it "pending the sittings of the present Royal Commission "on Water Supply." But the Progressives of the Council still look wistfully towards Wales; and plans and sections of the Wye portion of the famous scheme are in course of preparation. It is left to the Companies, not only to devise, but to carry out plans which will prove of immediate service. While the Council are preparing diagrams, the Companies are constructing works.

A letter from Mr. Beachcroft appearing in the columns of "The Times" has brought out a rejoinder from Mr. Stuart, "the eminent member both of Parliament and of the "London County Council." The point of variance arises out of the censure pronounced by Mr. Stuart at a public meeting; blame being cast on the East London Company for not having made provision for getting water from other Companies in case of need. Mr. Stuart's own quotations from evidence given by Mr. Bryan on the Company's Bill of last year, abundantly prove that the Company were alive to the necessity of being prepared to supplement their own supply. The contention arises as to the time and manner of carrying out this idea. It is acknowledged that the Company "urged upon Parliament" the adoption of a clause by which they should be enabled to obtain water from other Companies. Mr. Beachcroft says the County Council opposed the introduction of this clause. Mr. Stuart declares that "this is quite a mistake." But he fails to prove that there is not some foundation for Mr. Beachcroft's assertion, contenting himself with saying that the clause was passed. And so it was, but with a proviso added at the instance of the Council, whereby it was rendered obligatory on the Company to obtain the consent of the Local Government Board before taking a supply "in cases of emergency" from any other Company. It is fair to infer, as stated by Mr. Beachcroft, that the interchange of water was looked upon with disfavour by the County Council "from the purchase point of view." But now the power of getting water to aid the East London supply being obtained, Mr. Stuart complains that the Company have allowed more than a year to pass by without acting upon it. That they are making a *bonâ fide* effort to exercise such power cannot be denied; but Mr. Stuart considers it "a belated" affair, and asks why the Company did not set to work much sooner. It must be

remembered that at an early period of the drought the Company drew a supplemental supply, amounting recently to as much as six million gallons a day, from the New River Company. They are now constantly drawing a moderate quantity from the Kent Company, and very soon they will obtain important aid from the Southwark and Vauxhall. Who could have foreseen the necessity for taking such steps at an earlier period? Does Mr. Stuart even now believe in the drought? There are many who do not, even though the whole country is becoming parched, so that cattle are suffering, and the milk supply is running short. "London" and the "Daily Chronicle" have both derided the idea of a drought; and yet we find the East London Company blamed for not having foreseen all that has come to pass, and provided against it "long ago."

Though disappointed in the effect produced upon their resources by restricting the supply to four hours per day in place of six, the East London Directors were able to pass through last week without any further reduction in the service. This was better than could be expected; and it looks as if the present supply would be continued until the crisis is altogether tided over by the completion of the junction which will bring in five million gallons per day from the Southwark and Vauxhall system. If this can be speedily accomplished, the relief to the strained apprehensions of the public will indeed be great. The Hackney Vestry, which for some occult reason or other maintains an attitude of violent opposition to the East London Company, has also had its little quarrel with the Local Government Board, that department having presumed to ask the Vestry to use its best endeavours to diminish the waste of water going on in the district. The Vestry denies that there is "a shred of evidence" to show there is any waste of water. Yet there is the personal testimony of the special correspondent of "The Times," as an eye witness of the proceedings, that when a deputation from the Hackney Vestry challenged Mr. Bryan to prove the accusation of waste, and a bundle of letters was produced from which that gentleman proceeded to read in support of the allegation, the chief spokesman of the deputation and several of his followers rose abruptly and left the room. Yesterday the leading journal gave a few copies of the letters, clearly establishing the charge of excessive waste. As affecting a body of higher status than the Hackney Vestry, it is rather amusing to find that the County Council, which has been appealed to as the one beneficent power to end all the water troubles, has now excited "some indignation" in Limehouse by its sluggish response to a request that it would lend a couple of fire-engines to pump water from the Thames for watering the roads and flushing the drains. The great water authority that is to be, has evidently failed to recognize the duties which appertain to such a responsible position.

Gas, Water, and Electric Lighting Statistics.—Messrs. Hazell, Watson, and Viney, Limited, send (somewhat later than usual this year) their two annuals—"Gas and Electric Lighting Works Directory and Statistics, 1898," and "Water-Works Directory and Statistics, 1898." Both books are said to have been revised to July 1 last; and as these are the twenty-second issues in each case, there should not be much room for error. The electric lighting section of the first-named publication has this year been largely added to. Particulars are given of "the whole of the works now running, and a record of the principal Provisional Orders granted by the Board of Trade to Municipal Authorities and Public Companies, with the position in which they now stand."

Water Softening by the Archbutt-Deeley Process.—At the last monthly meeting of the Institution of Mechanical Engineers, a paper describing water softening and purification by the Archbutt-Deeley process was read by Mr. Leonard Archbutt, Chemist to the Midland Railway Company. It is unnecessary to discuss the desirability of softening and purifying the water required for various purposes, when the natural supply unsatisfactory in these respects. The Archbutt-Deeley arrangement is an intermittent, not a continuous-flow, system. The reagents employed are lime and anhydrous carbonate of soda; and the operations comprise agitating the contents of the mixing-tank by steam, and carbonating the water by means of the combustion gases of a coke-stove. The plant is described as being cheap, simple, and easily worked. The process has been at work since January, 1892, in the Derby works of the Midland Railway Company, clarifying as well as softening the sewage-polluted water of the River Derwent, and reducing the hardness from 15° to 4½°—effecting considerable organic purification, at an inclusive cost of chemicals, labour, and interest on outlay of about 1d. per 1000 gallons.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 600.)

THE course of business in the Stock Exchange last week was eventful and interesting. The opening was most cheerful and buoyant on the strength of the decisive operations in the Soudan; and the tendency was well confirmed by other favourable influences. Prices rose freely; and as the attendance became more numerous, business grew brisk. But just when the upward movement was in full swing, like a bolt from the blue came the news of the Candia affair; and it sustained a rude check. Other disagreeable influences also cropped up. The result was that prices were all huddled down again; and at the close the losses more than counterbalanced the gains. Even the Money Market had its phases; for considerable ease characterized the earlier part of the week, while in the latter portion rates hardened appreciably. In the Gas Market, there was certainly more activity than in the preceding week; but still business even then did not amount to much. In fact, for a considerable time past, there has been a very decided falling off in the volume of business transacted. Speculation has run more in electric lines. Variations in the value of Gas securities have not been numerous, or considerable in size; and they were irregular in direction. In Gaslights, the "A" maintained about middle figures until Friday, when it dropped as low as 288; and although it changed hands on Saturday at better prices, the quotation did not recover. Even the "H," which was stronger in the preceding week, was inclined to droop. South Metropolitan was quiet, and offered no feature. Commercials were steady and unchanged. Among Suburban and Provincial Companies, the only incident was a fall in British, in view of a considerable reduction in the rate of dividend. Among the Continental undertakings, Union and European were dead-quiet; but Imperial showed out with another advance in value. Of the rest, Oriental had a further rise, and Hong-Kong and River Plate improved; but Monte Video was lower. Hardly anything was done in the Water Companies. East London was lower; and what it lost New River gained.

The daily operations were: Business in Gas was quiet and unimportant on Monday; and quotations did not move. Things continued very inactive on Tuesday; but Hong-Kong rose ½, and Oriental ¼. British, however, fell ⅛. Wednesday produced only moderate business; and movements were adverse. British receded 1; and Monte Video, ½. On Thursday, the only noticeable feature was an advance of 1 in Imperial Continental. Transactions on Friday were about at their quietest; and prices were only poor. Gaslight "A" receded 2. In Water, East London was 3 lower, and New River 3 higher. Saturday was very quiet; but the tendency was more favourable. Imperial Continental rose 2; and River Plate, ¼.

DR. BUNTE'S COMMENTS ON WATER GAS.

THE paper by Dr. Strache, of Vienna, on "Improvements in Lighting by Water Gas," of which we last week completed an abstract translation (see p. 532), and a paper by Dr. Leybold on "Carburetted Water Gas," to which reference has also been made (*ante*, p. 201), have called forth from Dr. H. Bunte some interesting comments.

Non-carburetted water gas, he says, is one of the "children of sorrow" of gas manufacture. Since Donovan, nearly 70 years ago, sought to make practical application of the conversion of steam into water gas by incandescent carbon, there have always been enthusiasts who have had great hopes of the process. But almost all their attempts to utilize it have ended in failure; and it is difficult to credit favourable reports. Recently, however, tremendous strides have been made, both in the production and in the application of water gas; and the altered aspect must not be overlooked. One of the first water-gas plants on modern lines was erected at Frankfort-on-the-Main in 1880-81, and was thoroughly investigated. The result of the investigation was not very favourable to the system, as only 45 per cent. of the heating value of the fuel which was put into the generator was preserved in the water gas. Analyses and readings of the temperatures showed that the loss of 55 per cent. of the heating value of the fuel in the course of its transformation into water gas, arose chiefly from incomplete combustion and imperfect utilization of heat during the blowing process. Until quite recently, little improvement has taken place in the direction of securing a higher duty from the fuel. In 1886, a well-known German plant showed an efficiency of barely 50 per cent.; and this agrees with the results obtained with American plant.

Recently, however, Dellwik has devised a process in which, by means of a strong blast and a shallow bed of fuel in the generator, the formation of carbonic oxide is avoided, and complete combustion to carbonic acid is secured. One important source of loss of heat is thereby removed, and a much larger yield of water gas is obtained. The author was dubious of the advantages claimed for this process, so long as he had merely the

patent specification on which to base an opinion; but his doubts have been completely dispelled by a personal investigation of the plant at the Warstein mines. The results of his researches were perfectly concordant, though the investigation was not—nor did it need to be—a very prolonged one; and a computation of efficiency made in precisely the same manner as that in which the efficiency of the Frankfort plant was computed seventeen years earlier, led to the following conclusions: Of the heating value of the coke, 72 per cent. was preserved in the water gas; 16 per cent. was lost in the hot gases which escaped during the "blow" at a temperature of about 1650° Fahr.; 8 per cent. was lost in the hot water gas; and the remaining 4 per cent. was lost by radiation and conduction from the plant. An efficiency of over 70 per cent. of the heating value of the fuel is an extremely good result for an apparatus which works at so high a temperature as a water-gas plant, and is in consequence of its high temperature subject to great losses.

Another apparatus inspected by the author during last winter was that of Dr. Strache at the Pathological Institute of the General Hospital at Vienna. In addition to economy arising from the superheating of the blast and steam, an important advance achieved in this apparatus is that it is adapted to consume coal in place of coke. When water gas is made at a coal-gas works, no gain results from the use of coal, because coke is usually obtained at a cheap rate; but when water gas is produced independently of a gas-works, coal is often the cheapest fuel available. Moreover in places remote from bituminous coal fields, descriptions of coal unsuitable for gas or coke production can be used in the water-gas plant. Dr. Strache has proved that water gas can be successfully applied to the lighting and heating of buildings. At the Vienna Pathological Institute, about 500 burners are used for lighting, and about the same number for heating purposes. The lights are steady, and of a fine colour; and for microscopical or other delicate work, they are far superior to the electric light. The dissecting tables are flooded with light in a manner which other means could not readily equal. The heat evolved is comparatively little. Water gas yields only about half the heat given off by an equal volume of coal gas; and as Dr. Strache's water-gas burners consume per candle-hour about as much gas as the ordinary Welsbach coal-gas burners, it is clear that the heat evolved is relatively very low. With regard to the hygienic aspects of water gas, on account of the large proportion of carbonic oxide which it contains it would be unwise to speak very confidently until the Vienna installation has been in use for a greater length of time. It may, however, be observed that the surgeons, chemists, and pathologists of the Institute are using the water gas in their own rooms, and are undoubtedly quite satisfied that the method of illumination is a hygienic one.

Dr. Strache has stated quite correctly that water gas is at least as favourably placed with regard to risk of explosion as coal gas. The powerful odour which carbylamine imparts to the gas is an immense safeguard. In order to compare the risks of explosion with mixtures of various gases and air, Dr. Eitner and Herr Trautwein made a number of experiments in the author's laboratory. The results are embodied in the following table:—

Explosive Limits of Combustible Gases and Air, expressed in Volumes per Cent. of the Combustible Gas in the Mixture.

Combustible Gas.	Limit at which Explosion Ensued. Lower.		Upper.
Benzoline	2·6	..	4·8
Pentane	2·5	..	4·8
Benzene	3·1	..	6·3
Acetylene	3·8	..	(40·0)
Ethylene	4·2	..	11·5
Methane	6·4	..	12·8
Coal gas	8·0	..	19·0
Hydrogen	9·5	..	66·3
Carbonic oxide	17·3	..	74·8
Water gas	12·5	..	66·5

Very small quantities of the readily boiling hydrocarbons, benzoline and benzene, and slightly greater quantities of acetylene and ethylene suffice to produce an explosive mixture. From 7 to 8 per cent. of coal gas gives an explosive mixture with air; but about 12·5 per cent. of water gas of ideal composition (equal volumes of hydrogen and carbonic oxide) is needed to give the same result. There is another aspect of the limits of the proportions in which the gases form explosive mixtures, which must not be overlooked. There is no doubt that the explosive mixture which is formed by water gas permits of very thorough utilization of the heat of combustion of the gas in gas-engines. So far as the author is aware, water gas has hitherto only been tried for motor use with successful results in England; but this application of the gas will no doubt extend itself shortly.

The fact that water gas affords a smokeless flame without a primary air supply as in atmospheric burners gives it an immense advantage, as the risk of the flame striking back is avoided. The Welsbach burner made disillumined coal gas an agent for the dissemination of light; and now it is known that non-luminous water gas is capable of giving the same effects, it behoves us to watch the advances in the economy of the water-gas process, and to regard water gas not as an undesirable competitor with coal gas, but as an ally which will enable the gas industry to retain for many years its pre-eminent position as a dispenser of light, heat, and power. If we put to ourselves the questions whether coal gas is now employed—as it was ten years ago—exclusively, or even to the largest extent, as an illuminating agent, and whether the illuminants which are assessed by the photometer now have the same value as they had before the introduction of the Welsbach burner, we are compelled to answer them in the negative. Wherever the bunsen burner is used, whether for lighting by incandescence or for cooking and heating, the illuminants of coal gas are intentionally destroyed, and the flame is made into a non-luminous heating flame. The more incandescent lighting, and the use of gas for cooking and heating spread, so much the more are the illuminants of the gas depreciated in value; and the employment of disillumined or non-luminous gas increases at the consumers' burners. The question, which was at one time much discussed, whether it is advantageous to supply rich or poor illuminating gas, now admits of no argument. To-day the question which arises is, To what extent is it advantageous to make coal gas or water gas from the coal? The answer is controlled in a large degree by the value of bye-products; for they play an important part in determining the net cost of coal gas, and water gas affords an advantageous means of disposing of coke, which is the chief bye-product of coal-gas manufacture. Bye-products are not formed in water-gas manufacture; and with depression in the value of bye-products, the conditions become more and more unfavourable to the illuminating coal gas, and more and more favourable to non-luminous water gas. Gas engineers have to choose the methods of manufacture which are fitted to supply towns with light and heat in the cheapest and best manner.

If the recent advances in water-gas manufacture enable one to prophesy a brighter future for that gas, it would nevertheless be a mistake to omit an earnest admonition. Water gas has already been described as one of the "children of sorrow" of the gas industry, for its past has been by no means untarnished. Wild speculation has repeatedly retarded a sound progress of the water-gas industry. Companies have risen and fallen; and a year ago the London Law Courts witnessed the final act of the wreck of the English Syndicate which, under the guidance of Samson Fox, led to the loss of millions. The reputation and usefulness of the gas industry will be best maintained by honest scientific work, rigorous introspection, and a creditable spirit of enterprise.

BIRMINGHAM AND ITS WATER SUPPLY.

An interesting work dealing with the future water supply of the capital of the Midlands—written by a former member of the Birmingham Corporation Water Committee—the third edition of which has just been received,* calls for some extended notice at the present time, seeing that the author claims to have so far "revised and enlarged" his book as to constitute it "a contribution to the question of the water supply of large towns." Mr. Barclay dedicates his work to Mr. E. Lawley Parker, J.P., during whose mayoralty the Corporation Bill was promoted, and who (in the words of the author) "rendered conspicuous service during the parliamentary campaign which resulted in the Bill being carried into law, and upon the death of Sir Thomas Martineau was unanimously chosen to occupy the onerous and honourable position of Chairman of the Water Committee."

The former edition of the book contended that the future needs of Birmingham could only be supplied by bringing water from a distant source; and, after reviewing the available gathering grounds (local and distant), it showed that the watershed of the Elan and Claerwen was the most suitable for the requirements of the increasing population of Birmingham. The scheme adopted by the Birmingham City Council on the recommendation of Mr. James Mansergh, M.Inst.C.E., with its estimated cost, was then fully set forth; and the method for raising the necessary capital, with provision of a sinking fund without augmenting the rates, was explained. In the present edition, a new financial table has been introduced, and is that which was used in evidence before the Parliamentary Committee. The text dealing with this table has been amplified and re-written. There are also five additional chapters, which show how the Act of Parliament was obtained, with particulars of the evidence given before the Committees of both Houses by the scientific witnesses both for and against the Bill. The nature of the local opposition—also that of London, Hereford, the Welsh landowners, and others—is next dealt with. The clauses agreed to by the Corporation, and inserted in the Bill to meet these various opponents, are given in detail; and the discussions on the Bill as it passed through both houses are epitomized. In another chapter the steps taken by the Water Committee of the City Council, both in regard to finance and for providing an increased supply of water during the construction of the Welsh works, are explained; and it is shown how the actual expenditure comes out as compared with the original estimate.

The main portion of the new edition is, however, devoted to showing the progress of the works in the Elan Valley, and on the line of route. These works (said to be the largest of the

* "The Future Water Supply of Birmingham; With References to Liverpool, Manchester, London, &c.; being a Contribution to the Question of the Water Supply of Large Towns." By Thomas Barclay. Third Edition. Birmingham: Cornish Bros.; 1898.

kind attempted in the country) possess several special engineering features. The works are, as we have had occasion to report from time to time, in full progress; and the construction of the compensation reservoir, the submerged dam, and the other reservoirs which are in hand is explained. The description of the plant used, including the compressed-air apparatus, the crushing plant, and the automatic weighing cranes for handling enormous masses of material, is particularized. The laying down of railways, the making of roads, and the skilful organization by which the work is being carried out, are all described; as are also the operations on the line of aqueduct, including the tunnelling of mountains, the crossing of rivers, the method adopted to prevent disaster by the bursting of pipes, and other devices such as the wash-out and air-escape valves. The way by which the water is brought through the aqueduct to Birmingham, with its gradual fall of only 170 feet in 73 miles (although during its progress frequent descents have to be made into the river valleys, and subsequent ascents made to the level of the hydraulic gradient) is fully explained. A description is also given of the filter beds and reservoir at Frankley, and also of the service reservoirs at Warley and Northfield.

An interesting feature of the book is an account of the provision made by the Corporation for the workmen and their families in the Elan Valley; and the regulations controlling the supply of intoxicating drink in the canteen. The social results of this experiment are detailed; and it is stated that the canteen profits are devoted to the social and intellectual welfare of the inhabitants. The whole cost of the day school, beyond the Government grant, has been met from the canteen profits; and the expenses of the public rooms (including the library, the gymnasium, &c.), together with the salary of the missioner, comes out of the fund, while the bath house and hospital have been handsomely subsidized from it.

In the final chapter there is an account of the Liverpool and Manchester new water undertakings, both of which have been completed since the issue of the former edition. The cost of these schemes, and many other particulars, are given for the guidance of those who are interested in the carrying out of such enterprises. In the same chapter the present condition of London, in relation to its water supply, is touched upon by the author.

The book is copiously illustrated, showing the present stage of the works both in the Elan Valley and on the line of aqueduct. There are also numerous maps and charts. The most important of these is the coloured map giving the geological formation of the line of aqueduct, with many other engineering particulars. A sectional chart of the reservoirs is also included, and the model of the watershed which was used before the Parliamentary Committee is reproduced.

Gas-Lighted Buoys.—An article on "Illuminated Buoys" appeared in "The Times" last Tuesday; and the greater part of it was devoted to a description of the use of oil gas for lighting these useful guiding marks to mariners. The article did not do much in the way of advancing knowledge on the subject from a technical point of view; but it did show that this form of lighting buoys was rapidly growing in estimation. Recognizing the great value to navigation of lighted buoys, the Elder Brethren of the Trinity House have done much to encourage the development of the system in this country by placing gas-lighted buoys at many important points in the channels at the entrance of the Thames, in the Solent, and elsewhere. This example has been quickly followed by the Scottish Lighthouse Board, the local authorities for the Mersey, the Clyde, the Tees, the Ribble, King's Lynn, and sundry other seaports; and now on the coasts of the United Kingdom, there are close upon 100 gas-lighted buoys in position. In the Suez Canal, in Canadian and Australian waters, these buoys are already in use. In America also a considerable number are employed; but the United States Lighthouse Board have also some electrically-lighted buoys in Gedney's Channel approach to New York, which system, as now worked, is said to be very expensive, and liable to frequent interruptions of current. In France, too, the lighting of buoys by means of gas has been largely adopted of late years; and in Germany, Denmark, Russia, Holland, and Italy numerous gas-lighted buoys have replaced unlighted ones. It may truly be said that the development of this system is the most important improvement in our coast-marking arrangements that has taken place in the last twenty-five years. An "Ex-Member of the Clyde Lighthouses Trust" has subsequently written to claim that to the Northern Board is due the credit of introducing a complete system of illuminating gas buoys. He says: "After testing the matter thoroughly, the system was adopted; and a gas-works and special steamer were constructed at Port Glasgow for carrying out the service, which now consists of gas buoys and beacons at various points on the Firth of Clyde, besides foghorn installations at Toward and Cumbrae lighthouses. The example thus set was followed at a respectful distance by other Boards, including the Trinity House, whose dealings with the invention in its initial stages appear to have been on all-fours with its treatment of the Doty oil and Wigham gas burners (the latter of Tyndall resignation fame), which reflected anything but credit upon what claims to be the premier lighting board in the kingdom."

COMMUNICATED ARTICLE.

WAYSIDE NOTES.

By T. S. Cleminshaw, Assoc.M.Inst.C.E., of Colombo.

The various branches of gas engineering admit of so much difference of opinion, that to many it is the greatest bewilderment to attempt to arrive at a conclusion as to what is the best course to pursue in some of the leading departments of it. If, for instance, the student, or searcher for knowledge, takes up a paper on a popular subject, he is certain to find opinions so immediately opposed to one another that he is apt to give it up in despair, and fall back on his own resources. Happy indeed is the man who, in his time, has had the great advantage of travelling round works and jotting down his observations in his note-book. In some of the places visited, he will have seen things which he thinks are wrong; and he is apt to depart with a less exalted opinion of the man in charge. Put yourself in his place, and think how you would act—perhaps after taking the place of a man who was content to let things drift, or who, from the keen eye of his cheeseparing superiors, could not escape and put the works in order, and whose only criterion of a good works was the dividend-paying power, irrespective of its condition as a fully-equipped gas-works. Such works go on, necessitating an enhanced price of gas, through the mistaken employment of inefficient plant, when they should, by a judicious expenditure of capital, or a dip into a carefully nursed-up reserve fund, have been working on modern lines and selling gas at a cheaper rate. The old stack of retorts goes on and on steadily wearing out, till at last the goose that lays so many golden eggs is judged fit to die. A new bench must be built, on a modern system; and no provision has been made for its construction from a reserve fund, as, in their anxiety to get the utmost farthing of dividend, there was no chance of building one up. But when the change is effected, it means eventually a 20 per cent. increase of gas per ton of coal carbonized—perhaps more—and a large saving in coal and labour, which in the aggregate will wipe out the cost of these extensions in, may be, a couple of years, to say nothing of the saving in wear and tear of retorts. Who does not know of such works in his experience? The writer well remembers a case where, by an improved system of retort-setting, a considerable increase of gas could have ensued; but it was decided to build a new arch on to the old ones, with the intention, it is presumed, of "putting up wi' the deil ye ken."

But let us pay closer attention to the root of the matter. In laying out a new works, many are the methods of achieving the end in view. First and foremost comes the good old adage of "Keep down your capital expenditure." Certainly; but how? The designer knows a place where some discarded plant is rotting away, ready for melting down at its proper place, the foundry. So he goes round and makes a bargain for some old mouthpieces, ascension-pipes, a length or two of hydraulic main, a set of purifiers, and perhaps an old governor, for his new venture. Picture such a works. Ascension-pipes, 6 inches; foul main and condensers, 6 inches; purifiers, 4 inches; station meter, 3 inches; gasholder, 8 inches; and governor, 8 inches. The venerable articles compel him probably to put in settings of a different size and even shape in each oven. But this is anticipation.

Then the question of foundations no doubt is an important one, and meets with varied treatment. Let your readers watch a warm discussion of a paper in which concrete takes a leading position. Take note of the proportions one man says are sufficient to ensure success in this, to some people, simple mixture. The writer once rashly argued with a fellow engineer on this subject, and the debate became warm; but it cooled down on the gude-wife's exclaiming, "Eh, mon, but ye shouldna argy wi' him aboot concrete!" In this question of concrete, one man declares that it is absolutely necessary, on good ground, to use a 3, 2, 1 mixture, respectively of stones (2½-inch ring), sand, and cement. Another says 5, 3, 1. Yet others want 6 to 1, 8 to 1, 12 to 1. And so the battle wages. But now comes another element into line as the discussion goes on. Skirmishing changes to a general engagement when wet and dry concrete is considered. The "wet" man declares the "dry" man does not consolidate the aggregates thoroughly; and the other says the wet man washes the cement away. Both these men are correct, if judged by extremes—as they often are. In some places, the aggregates, in the shape of a clean shingle or ballast, containing the necessary small stones and good clean sharp sand, form an ideal concrete when mixed in the proportion of one cubic yard to a 400 lb. barrel of cement. In some instances the shingle may be of even larger proportion, and an efficient foundation or tank may be built out of the resultant mixture. But for the foundations of new benches in a works already installed, or for any concrete work, what can be superior to old fire-bricks, retorts, clinkers, and such like? Yet cases have been known of such being rejected, and expensive hand-broken stone put in their place—and that, too, by folks who considered themselves not wanting in business acumen.

For some retort-bench foundations a 3 to 1 sand and cement, among 9 parts of such old materials, has produced a concrete so

tenacious, after a few years' standing, that when generator firing was installed, and the centre of the arch required its concrete removed, gads of great endurance from heavy sledge hammers became necessary to effect the work. The concrete was then taken out in large and thoroughly incorporated lumps, which required two men to handle them into a barrow. Nor need the free interspersing of handy blocks of stone be neglected, taking care that they are well bedded and then amply incorporated in the mass of concrete. This concrete—9 to 1—placed *in situ* so that the water has been brought to the surface under the trampling of a navvy's boots, was harder to remove than the 3, 2, 1 mixture first mentioned. In the above remarks portland cement is understood. But lime, when it can be had of good quality, will serve the purpose as well; the proportion of lime being, of course, increased to achieve the same result.

When once the foundations are laid, then the mystery often commences. What sized settings shall be put in? Shall the exit-flue of an open-fire setting be at the bottom of the back of the arch, or by a hole in the crown? In a 60 million cubic feet works could be seen a system (!) which included twos, threes, fours, fives, sixes, and sevens. Again, in a works boasting 16 retorts, three in a bench at the most, no two settings were alike; and the chance of obtaining decent heats was remote, for the stack was built of limestone, and an overventuresome man in charge saw it melting at the inside of the oven when he increased the temperature. Here was made 25-candle gas, 9500 cubic feet to the ton, out of a coal from which others procured 12,000 cubic feet of 17-candle gas to the ton. In one instance a house was erected 24 feet wide, and 40 feet long, for a rising town. The retorts were 15-inch, rounds, 7 feet long. While the demand was small, not much inconvenience was experienced; but later on there was no room for the men to move round when drawing and charging, as they had to scramble over the coke and coal. Subsequently, the works were extended; and then came in vogue 15-inch rounds, 18-inch rounds, and 21 in. by 15 in. ovals—a somewhat confusing variety, and apt to be awkward if a bench gave out before its time, and no retorts of the special size were in stock. The latter system was due to the uncertainty as to the best shape to be used; but the newcomer promptly adopted the ovals, and confusion vanished.

Nor should a rather peculiar plan pass into oblivion. In a house capable of manufacturing 120 million cubic feet of gas per annum, the outer walls being still in excellent condition, the retort-bench was condemned when the make only reached 60 millions. A new house, costing several thousand pounds, was erected containing another retort-bench. Now had the old house been remodelled piece by piece, on a well-considered plan, much money could have been saved. The retorts in the old house were 16-inch circular, 20 feet long; and through a deep seal being employed, they became so much obstructed that a 6-inch sphere could not pass along a line stretched from centre to centre of the mouthpieces. The mode of charging these retorts was peculiar. First one side was filled, and then, in face of a flaming mouthpiece, the opposite side was manipulated.

The want of proper system in many small retort-houses is often painfully evident. In one house, eleven beds of threes, all iron, were put in, and had worked for some time, even when the retort-house was producing 17 million cubic feet, no exhauster being employed. This cannot be said to have been a reasonably modern system; and the continuance of such a building cannot be called common, even during the last two decades. By degrees it is becoming recognized that retort-arches should be built so as to be capable of easy working when the works expand; and the employment of fives and sixes is a real step in this direction—omitting the bottom retorts in the earlier stages, and making use of the space for regenerative flues on a small scale. In medium-sized works, of 60 or 80 million cubic feet capacity per annum, the employment of sixes leaves room for an easy step-up, month by month, in some places. But this should form a question of much importance as to the local conditions. Given plenty of gasholder room, and a reasonable rise in the demand, a bench of sixes each month "fills the bill" well, and for evenness of heating will take a foremost place for the medium works. It should be borne in mind that there are manufacturers of retorts who have a standard set of sizes for mouthpieces; and the bolt-holes then require no alteration. The manufacturers naturally complain about the multiplicity of templates; and, indeed, they are a formidable array in the manufacturers' hands. If some standard were adopted, they would be able to stock retorts ready for prompt delivery. The retorts are ordered in the spring of the year; and there is a rush to get them finished in time for the winter. But if standard sizes came in, a steady employment could be given to workmen in the winter. Anyone acquainted with "overtime" knows that speed, quality, and expense do not always receive equal consideration. And while considering the question of simplicity, may not a word or two be written on the shapes of tiles, blocks, and quarries of such and such patent regenerative or other furnaces; one man yielding to no one his preference or his absolute faith in a rebated joint, while another declares he gets just as good results from a plain square-edged tile? Some fire-clays, it is well known, have the property of shrinking after they leave the kiln, and get burnt afresh in the setting; but others remain true. Surely, then, economy points to the use of simple joints, which do not suffer in transit, and permit of great simplicity both of design and cost of labour. Experience proves that square joints can be used with good results. Witnessing an extension of retorts not many months ago, this multiplicity of blocks and tiles, with tender parts, many of them broken in transit, impressed the writer greatly.

We come to a somewhat delicate part of the retort-setting, when we survey the various schemes that have been laid before the gas world, in the shape of regenerative, recuperative, generator, full-depth, half-depth, and shallow-depth generators, a generator in the same position as the ordinary fire, and lastly the old style of open firing. But pausing to consider the best system, the searcher among technical records is struck with wonder, not far off profanity. He will, perhaps, take advice of a friend, who says to him, "Why, my dear fellow, nothing is simpler; try the regenerative full-depth furnace." May be he is not convinced, so asks a second friend, who says, "Try a deep generator, and heat the secondary air under the floor of the setting." Yet another advises him "to go in for none of those systems—frightful expense and risk. Why I get as good results as any of them," &c., &c. A large installation of gas-fired retorts recently formed the topic of information and good discussion in your columns, as well as among engineers. This setting was a simple kind of generator, with flues for secondary air under the floor of the setting; and a friend of the writer's pooh-poohed the system. He declared that no good would result unless a full and complete system of regeneration was installed; and that the idea of feeding with gaseous fuel a large number of retorts from one furnace, admitted of no regulation of the heats. The presence of dampers on the outlet-flues was pointed out, but all of no avail; it was non-regenerative, and that was enough. And yet success has elsewhere been found among simple settings such as these.

It is recognized among those who have tried it, that in these gas-fired furnaces the chief difficulty for a beginner is the proper regulation of air; and strange sights await the searcher after truth. One uses a proportion of primary and secondary airs as 1 to 2, another 1 to 4½, another 6 to 1, yet another 2 to 1; and so the proportions vary. Nor can this proportion be found out but by experiment, as two benches in one stack contain elements which demand a varied proportion of opening of the two shutters. Who is not familiar with this in the open-fire setting, though the bricks in a setting may be within a few dozen alike in size and quantity? A ready means to achieve the result is by watching the combustion chamber to see that combustion is good; and then, having weighed the coal in, weighing during three or four days the coke that is left after fuel has been taken for the furnace. If weighing is impracticable, measured bags may be used. The alteration of each proportion of openings in the shutters will then tell its own tale; always allowing sufficient time for the altered condition of air supply to take effect—say, three or four days in the week. It is well, in regulating the supply of air, to trust to shutters alone. In two cases observed, there were respectively a 1¼-inch and a 2-inch pipe entering the ashpan outwardly. Being horizontal, of course, they contributed their quantity of primary air; this being allowed for. Anyone who has watched the ordinary open-fired bench knows that hot lumps of coke detach themselves from the glowing body of fuel, and, falling below, swirl round and round on the top of the water, before some of them sink, but not all. Some eventually find their way to the overflow-pipe in the gas-fired oven, and obstruct the admission of air to the furnace. Only a detail one may say; but quite sufficient to upset the balance of air supply. Were the pipe sealed, there would be no such trouble. The overflowing water, in a blocked pipe, would rise till it reached the furnace frame, and then escape; for the doors, though planed, are exceedingly difficult to keep tight—demanding attention such as no ordinary stoker or furnaceman will give, and rendering the calculation of the air a matter that need not be carried to the extent it is when results are published, showing the amount to the decimal of a foot.

The writer has been fortunate in examining furnaces where the depth of cellar-floor, below the stage-floor, for the installing of gas-fired producers, has varied from 3 to 14 feet. One producer was set in a bed of sixes—neatly worked out, it is true, but doomed to failure, as the cold air and brickwork (the result of water trickling on the bars) rendered it impossible that the two bottom retorts should receive sufficient heat from a furnace whose fire-bars were almost in a line with the underside of the bottom retorts.

Let us examine the essentials of gaseous firing in an atmosphere free from too much technicality (for there are abler pens than the writer's), as a means of giving some of the less fortunate brethren a helping hand. The real object is to eliminate from the coke the gaseous elements, mix a proper proportion of air with the gas in the combustion chamber, and a fierce, clean heat is the result; while the mineral matter gradually descends to the ashpan for removal. The gas may be extracted in two ways—fast or slow, in shallow or deep producers, giving clinker or otherwise. Shallow producers are more apt to give clinker than the deep ones; but it is not always advisable or possible to make depth the sole consideration, as expense comes too largely into such a scheme.

In a shallow furnace, the time taken for the coke to reach the bottom is perhaps 4 or 6 hours; while in a deeper furnace it takes 30 to 35 hours to effect the same end. Consequently the evolution of gas from the coke is a much more gradual process, although the volume may be nearly identical. The zone of

combustion in the furnace is a very little above the bars, and below the top in the shallow furnace; but in the deeper one it is far enough from the bars not to cause clinker, which results from too great a heat being present when the mineral matter and gas from the coke are parting company. This brings on a very important consideration, which is no less than the desirability of using water or steam, under the bars of the producer, with the primary air. Passing through several works where gaseous firing was employed, the use of the two elements became the object of keen observation. The very general use of a supply of water on the bars caused reflection, especially when large lumps of fairly solid clinker could be seen in the heaps of pan breeze outside. It is admitted that the reason why water is placed on the coke at the bottom of the producer, is to raise steam. This is granted; but the constant passing of water on the coke, which rests on steeply inclined bars, cools it and the bars to such an extent that, shortly after the producer has been cleaned out and the coke cooled, there is not sufficient heat to raise the necessary amount of steam to avoid clinker—or, at least, to allow of its removal in a loose friable state. On the other hand, with the use of steam, so arranged that the volume issues to the middle of the ashpan, meeting in its upward course the primary air which comes through the doors, the freedom of clinker is indeed marked, and is a matter of much gratification to the men working the furnaces, by running three months at a time without requiring the use of clinker-bars heavy enough to be a load for a man to put in the furnace, but only a light rod of ¾-inch round steel flattened at the end. In this case, of course, the clinker was taken out in a "loose friable state."

Surely such a desideratum is answer enough to those who declaim the use of steam in these furnaces in lieu of water; and yet, during a recent discussion in your esteemed columns, one correspondent declared it was matter in a wrong place, and had no business there. It was presumed to be harmful, as it lowered the heats, and so spoiled the efficiency of the furnace. Too much steam will undoubtedly do this; but if a handy indicator is put on the wheel of an ordinary ½-inch steam-valve, and intelligently used, the workman soon finds out, for his own sake, the amount of steam needed to keep down the clinker, without sacrificing the heats. The indicator consisted of a circular plate ⅛-inch thick, provided with a hole large enough to pass the wheel of the valve, and a pair of clips to fasten it to the ½-inch steam pipe; while a pointed bent brass indicator allowed of an easy method of calculation. Before this was done, much waste was likely to occur as to the volume of steam; but afterwards the men expressed themselves satisfied, and on settings of six in a bed—the retorts being 22 in. by 14 in. by 9 ft. long—8000 cubic feet per mouthpiece was accomplished without any inconvenience in the ascension-pipes. In some of the large works, between 6000 and 7000 cubic feet per mouthpiece seems to be high enough to satisfy those in charge.

In the choice of retorts there is room for much diversity of opinion; and it often happens that retorts of one district are set among bricks from a different source altogether. Consequently trouble arises owing to the difference of shrinkage of the various materials. The same may be said of bricks. The employment of bricks bought at fancy prices, because on analysis they claim to possess certain percentages of silica and alumina, &c., is not always justifiable. An experience may not, it is hoped, be considered out of place. Some bricks possessing a high percentage of silica were purchased at 105s. per thousand, packed up in casks containing fire-clay to protect the fragile bricks. Later on a harder brick was bought at 47s. 6d. per thousand, which gave results equally good, and had the advantage of being of the same composition as the bricks inside the setting.

Then the question as to staying the retorts inside the setting is one of much importance, and has been known to range between spaces of 14 inches between the walls, with the old system of open-fired retorts, to alternate 4½ inches space and wall in gaseous firing. A spacing found to answer well was 12 inches with open-fired and 7 inches with gaseous-fired retorts; and the retorts were in better condition in the latter than in the former—even though the period under much hotter fire was more than double.

The spacing between the retorts vertically is a matter worthy of much thought and consideration—more than it is usually accorded, especially in medium gas-works. Some declare that 5 inches is the least that should be allowed, even with gaseous firing; but good results have ensued from 3½ inches space. Nor should the height of the retort be neglected; and as 13 inches is about the lowest that is practicable with scoop charging, so 18 inches is too great a height, and with many 14 and 15 inches has proved ample. When kept free from carbon, 14 inches will be found to work well; and every extra inch makes it harder for the men, in medium works, to raise the scoop to the top retorts, in benches of six, seven, eight, or nine in a bed. Starting with a 12-inch space under the bottom retorts, a 20-inch retort (14 in. by 3 in. by 3 in.), then 3½ inches space, a 20-inch retort, then 3½ inches space, and 3 inches as the thickness of a top retort, will give 5 ft. 2 in. as the height of the floor of the retort. Practical experience will soon convince a doubter of the truth of this statement. The employment of extra tall men as stokers is by this plan rendered unnecessary, thus permitting of a wider selection. It is understood that this applies only to medium and small sized works, which have not advanced sufficiently to make the installation of machinery advisable or profitable.

Let us pass on to the matter of stays for the bench, and we find a selection of styles to suit even the most fastidious. Bars of various shape, Tees, I section, I section with a plate at back to cover more surface, old rails of various shapes and sizes (sometimes four grouped together to form one buckstay), flat bars on edge (the worst of the lot), flat bars with angles riveted on them, and many more. True, it is a stay that is required to keep the bricks from creeping, especially at the division-walls. Consequently the surface of the brickwork should receive as much support as possible; and this cannot be done by the flat bars on edge. A pair of flange rails, Vignoles section, an I joist with a wide plate, riveted on to the joist at the back—say, 12 inches wide for a 14-inch wall, or 15 or 16 inches wide for an 18-inch wall—will be found a real preventive of creeping walls, if properly erected, and a strong enough transverse bolt used. The top end being left long enough affords means of supporting each single length of hydraulic main—a practice that has been condemned by some, but which, for convenience and safety, is finding increasing favour. This plan is slightly more expensive at first than the old style of continuous long lengths of hydraulic main; but the conveniences and ultimate saving outweigh the first cost. In the continuous system, there is practically no chance of keeping the seal of the hydraulic main, satisfactorily and automatically, at a constant level, and having a circulation of the tar at the bottom of the main.

Round the hydraulic main many skirmishes and battles royal have been waged; some of them traceable to simple causes for their solution and pacification, and others only solved by means of much labour and high language. The hydraulic main seems to carry a false name in many places, and would have been better denominated, according to some, as the "slough of despond." Its chief object being to seal the dip-pipes in water, care should be taken to remove any other element as fast as can be. Granted; but if the gas comes forward with all the water dried out of it, how then? Feeding water into the main is one practice indulged in, causing expense to raise the water; and another plan is not to dry up the incoming gas till it gets to the hydraulic main. In the case of some coals, they block up the ascension-pipes easily—especially when the bench of retorts has the flues so disposed that the hottest part of the retort is at the front, and a block occurs from the mouthpiece right to the bottom of the hydraulic main, necessitating the removal of the pipes and arch pipes amid the heat, smoke, and dust. Many have been the contrivances on, in, and about the hydraulic main—anti-dips, bye-pass pipes, removable seals, and cups that have the water blown out of them, and so unseal the pipes when the make is heavy, and fill up as the charge gets exhausted. An experience of some years has led the writer to believe that good results may be had with anti-dips, which, owing to peculiar circumstances, were adopted; but the hydraulic main, worked in a proper manner with a water-seal of even depth on the pipes—an easy matter when single lengths of main are employed—does its work well.

The subject has already run to such length, on account of the great interest of it, that a conclusion must be made. If, however, the writer's notes have been the means of interesting and assisting any of the members of the profession, the compilation of them will indeed have fulfilled the main object with which they were written.

The Gas Supply of Vienna.—Under the title of "An Anglophobists' Defeat: How Dr. Lueger had to give in to a British Company," the Vienna Correspondent of the "Daily Mail," writing last Friday, said: "Two years ago Dr. Lueger, the anti-Semitic Buergermeister of Vienna, boasted that after the smashing of the Jews he would smash the English in Vienna, and drive all of them out of Austria by the end of the century. One chief act of his administration has been his refusal to renew the contract with the Imperial Continental Gas Association for the lighting of Vienna. After involving the town in the expenditure of vast sums to build a new gas-works, and lay new pipes, Dr. Lueger has come to the conclusion that the English are indispensable, and has renewed negotiations with the Gas Company. I learn from the "Neues Wiener Journal" that the negotiations resulted in the renewal of the English Company's contract for the greater part of Vienna. This surrender to the English Company is the most serious defeat the anti-Semites have suffered." Commenting on this news, the "Pall Mall Gazette" says: "British enterprise has found an open door at last. What is more, the said door had been shut and padlocked for two years. The Vienna correspondent of the 'Daily Mail' reminds us that Dr. Lueger, the Anti-Semite burgomaster, had boasted that, after smashing the Jews, he would smash the English, and drive them out of Austria by the end of the century. He began, in a very small way, by boycotting the Imperial Continental Gas Association, which was under contract to light Vienna. He went on, in a much larger way, to build new gas-works, pull up the Semitic-British pipes, and lay down fresh and patriotic ones. But, alas! the business was a failure, and an expensive one, too. Dr. Lueger has renewed negotiations with the Company, and they have forgiven and forgotten. 'This surrender,' adds the correspondent, 'is the most serious defeat the Anti-Semites have suffered.' It is also a most damaging confession for Dr. Lueger himself. If there was one thing in which he might have been expected not to fail, it is the production of gas."

TECHNICAL RECORD.

WAVERLEY ASSOCIATION OF GAS MANAGERS.

Half-Yearly Meeting at Duns.

The Seventy-fifth Half-Yearly Meeting of this Association was held at the White Swan Hotel, Duns, on Thursday last—Mr. J. M'Laren, of Duns, the President, in the chair. There was a good attendance of members and their friends.

The Hon. Secretary (Mr. W. B. M'Lusky, of Selkirk) stated that he had not thought it necessary to prepare any report for the Committee who were appointed at the preceding meeting with reference to the efforts of the North British Association for the standardizing of meter-unions. They were all aware of what had been done in the interval. The matter was now in the hands of the Council of The Gas Institute; and they had not thought it needful to take any action upon it.

The decision of the Committee was approved; and they were continued in office.

The President's Address.

The President then delivered the following address:—

Before commencing my address, I must thank you for the high honour which you have bestowed upon me in electing me President of the Waverley Association of Gas Managers for the present year. When I was proposed for this office, at a meeting last year, I could not but appreciate the great compliment. But I felt considerable doubt as to my ability to fill the post satisfactorily; and it was only with the firm conviction that I could, if selected, rely upon the help, not only of the Association, but also upon the help of all of you, that I agreed to my name being put before you for the post. I have already felt some of its numerous responsibilities and worries; and not least among these is the preparation of an address. If I could put before you something entirely new in gas undertakings, I might feel justified in asking your attention for some short time. But as I have nothing new, I must throw myself upon your mercy, and ask you to excuse and overlook all my manifold defects. The few remarks I am about to make are simply intended to show some of the difficulties the manager of a small gas-works has to contend with.

In speaking on this subject, let us imagine a works making (say) from 5 to 10 million cubic feet of gas per annum, and that the works are old and out of date—too small to meet the demand put upon them in midwinter—and also that the company cannot afford to, or will not, reconstruct the works, or that they think reconstruction will not repay the outlay. Not a very bright outlook, you will say. Well, no, I grant that. But how many managers of small works have much better? Let us first of all examine the duties of the manager of such a works. He has to be on the works early in the morning, to act as his own time-keeper, and to see that all his plant is working properly. He is, naturally, responsible for the correct working of the concern, has to keep all books, and sometimes, when called upon, to be his own stoker, main-layer, fitter, and, if pressed, his own labourer. He has also to inspect meters, look after the public lamps, and, when necessary, do all testing and drawing. He is liable to be, and frequently is, aroused in the night to attend to some accident on the works. Of course, his chief object is to make as much profit as possible. This is no easy matter with the plant he has to work with; added to which he will have to pay heavy carriage on coal and residuals, as small works are usually out of the way of collieries, and often far from a good railway line. If you inspect his retort-house, you will see that he has three single benches of three retorts—nine retorts in all. His furnaces are direct-fired—burned beyond repair, as likely as not—and his retorts are patched and cracked. These he has to make work by some means or another.

In small works as in large, the retort-house is the most vital part, more especially as regards money-making; and upon the efficiency of the carbonizing plant proper depends the financial results of the business. If money is lost there, or the working is not economical, no amount of care and attention afterwards will be of much benefit. He cannot work as cheaply as in the case of a large works. Even though his plant is good, he cannot compete with works using stoking machinery, inclined retorts, and other labour-saving appliances. Besides, these would not pay in so small a place. The works will be too small to allow of storing coal in any quantity. This places him to a great extent in the hands of the colliery proprietor who holds his contract for coal, as regards the running of waggons, which will run fast enough in summer when neither he nor anyone else wants them; but in winter, when the demand for coal is high, he has a great deal of bother to get any coal at all. And when he does get it, it is wet through, or may be covered with snow; and it has to go into the retorts just as it is, much to the detriment of the heat of the setting.

In midwinter it will suddenly spring upon him that the beds cannot be got hot, and no one knows the reason; or else he finds out that there is no draught up the chimney, nor can he obtain any. Then, after almost superhuman efforts, he discovers that the main-flue is blocked with dirt, ash, or dust. This he manages to clear temporarily. Then either his exhauster will stop or some of his connections will get blocked up with accumulated tar and liquor, &c.; thus causing a big back-pressure, and not infrequently blowing the liquid from his hydraulic main into the retorts. If in midwinter, when the whole of his retorts are working, a fog should come on suddenly, and the consumption owing to this become greater than the make, he has to get up furious heats in as short a time as practicable, to obtain the greatest possible amount of gas in the least possible time. This is often the source of trouble with the ascension-pipes, as a thicker tar is produced, which forms pitch sooner than lighter tar would. Or, if the benches are not in the best condition, an arch may drop in; and perhaps a retort or two may then get burned through.

From the retort-house, the gas is led through the foul main to the condensers. This main may be a 6-inch one, which is far too small; and the condensers may be totally inadequate to cope with the full make from all the retorts. Then, again, the 6-inch main may have filled up badly in the years it has been down, and the condensers and inlet and outlet of the scrubbers may be in the same state; and it would be nothing new for the pipes to choke up and put the works in a mess with back-pressure. The exhauster may suddenly break down, causing such a pressure that it would be easier for the gas to find its way through the porous sides of the retorts than against the pressure thrown by all the different pieces of apparatus. The manager will then have to set to and repair the exhauster; for he has no other to put on in cases of this sort, and this one may have been working for years, and not have been touched in the way of repairs.

The purifiers will be too small for the maximum make—in fact, they will hardly last for three days in the busiest season; and if one is taken off to put fresh oxide or lime in, the remainder go dirty sooner, as they have more work to do. The purifier centre-valve may be old, and the faces not true, in which case the gas will leak from one purifier to another. There may also be a water-valve or two about the place; and these have a nasty way of freezing, or going wrong just when wanted. The station meter may be too small, or out of order—useless, perhaps—in which case the manager does not know what amount of gas he is making or delivering. If his gasholder is far from the boiler (supposing he has a boiler), so that he cannot get steam into the cups, it is quite usual for the water to freeze in winter and bind the holder. Should this happen in the morning, when the consumption of gas is less than the make, a pressure is thrown which will blow the water out of the purifier lutes. If it should happen at night, when the consumption is greater than the make, the holder becomes fixed, and the pressure becomes less and less, until at last the town is put into darkness.

The manager of a small works is quite as much troubled with naphthalene deposits as the manager of a much larger works. Besides the troubles known only in small works, he has to contend with the same as his better-off brother in the large works. He has, like the manager of large works, to attend to the complaints of the consumers; keep the gas free from impurities, and above, or at least equal to, the candle power prescribed by his Act; to keep order; and, above all, to "make money."

And now I will not detain you any longer. I have tried to keep as near my title as possible; and in so doing I am afraid it may appear to you that I have been relating a chapter of accidents. But, at the same time, I think I have shown some of the difficulties the managers of small works have to contend with. If I should have succeeded in interesting you for a short while, I shall have attained my chief object.

Discussion.

Mr. H. Rutherford (Aberlady) said he thought they ought to thank Mr. M'Laren for his address. He had shown them many difficulties which a small gas manager had to encounter.

Mr. D. Vass (Edinburgh) said he could quite bear out what the President had said—that many of the difficulties which he had pointed out faced them all on entering upon duties in a works which were strange to them. The first winter in a new works was a very trying time to any gas manager. Even in the smallest works, a new manager should, during the first summer he was in charge of them, make a thorough inspection of the whole plant. This would enable him to overcome many of the difficulties which had been mentioned. By such inspection, they would find out, for instance, if the main flue was clear, or could have the condensers steamed, supposing there was steam on the works. The washer and the exhauster could be looked at; and he thought it was always advisable to employ a mechanic in the summer to overlook the exhauster. His experience was that, if if they tried themselves to patch up the exhauster, it might go wrong just at the time it was wanted. Even if it were overhauled by a mechanic, an accident might take place; but then they would have the satisfaction of being able to say that they had done the best they could to prevent any such difficulty. The President had confined his remarks to works of from 5 to 10 million cubic feet; but the same difficulties were to be found in works as large as from 20 to 40 million cubic feet. Of course, in the larger works there was a bigger staff to deal with difficulties; and they might be got over sooner. One little trouble which he had to overcome, and which could not be foreseen, was with what was called a self-acting trap. He believed they were not unusual in distributing-mains. In this particular case, it had been put on when a new 10-inch main had been laid from the holder; and it gave no

trouble for years. But one evening the pressure suddenly fell; and had it not been for a small district holder, it might have gone down to 2-10ths or 3-10ths. As soon as the decrease was noticed, the holders were reversed, and arrangements were made to fill one which was nearly grounded. It took them about three days to find out the defect. A lead pipe had been laid, to work by a syphon arrangement; and there having been a flood in the district, the water, instead of having been drained off by the syphon, had been drained in, and had filled the main to a few inches from the top.

Mr. W. BLAIR (Haddington) said they all knew very well that small gas-works were a training field for managers for larger works. He had had experience in both small and large works. As the manager of a small works, he had always made it a point, about this time of the year, to thoroughly overhaul the whole of his plant—to take particular notice of the condition of the pressure-gauges and such things, and of how the gas was going right up to the holder. And he might say that he had never experienced a complete choke-up; he had never had anything which could not be remedied in a few minutes. He had had his trials and difficulties, like others; but he had always found that attention to the matters he had mentioned enabled him to get on very well. In Haddington, he had not had a cap or pipe open for the last seven years, except for these inspections. He had a small steam-boiler; and he found that by it he could clear away, in five minutes, any obstruction which was likely to occur between the gas outlet and the purifiers. He had an exhauster and washer, and almost all the recent appliances which could be introduced into gas making. He had found the re-modelling of the works to be of the greatest advantage. They had reduced the price of gas from 5s. 10d. to 4s. 7d. per 1000 cubic feet. He thought that even in works down to a million cubic feet, it was worth while considering whether they should not introduce the latest appliances. He had no doubt it would be found to be of advantage in the long run—at least, that had been his experience. With reference to pitching, he might say that, in cases where retorts had been lying off, it was advisable, before they were re-started, to examine the dip-pipes, because there might be found, at the bottom of them, an incrustation, which could be easily cleared away, but which if left would obstruct the passage of gas.

Mr. A. C. YOUNG (Kelso) said he had always found that the bane of the gas manager's life, in the winter, was the thing which happened suddenly. This trouble all his life had been with the hydraulic main pitching up. It was a difficulty he had never been able to overcome. He had found that high heats were always the cause of it. He would be very pleased to know how it was to be got over, because some managers held it was the coom, or gum, of the coal, especially in the case of small or drossy coal; while others said that it was the rich cannels, such as Newbattle. He had found it to take place even with common cannels, when the heats were high. Condensers were very apt to choke; but as Mr. Blair had pointed out, if they were cleaned out regularly, this might be avoided. It was a very good thing to have steam ready to be turned on at any moment; but he had never found steam to cure the pitching. He had heard that running water was effectual in preventing it; but had not found it so. He had had to take off the mains and remove the pitch by means of hammers and chisels, which was sometimes a dangerous operation.

Mr. BLAIR said he employed as high heats as anybody. He produced close upon 11,000 cubic feet of gas per ton of coal; and this, he thought, was a sign that he used fairly high heats. He might sometimes have tough tar in the hydraulic main; but he would not call it pitch. In his main, he had a baffle-plate fitted in front of the hydraulic valve, dipping 2½ inches into the liquid, and rising the same distance above it, so that all condensable matter had to go beneath; and he was not bothered with any pitching whatever in his main. He used the best cannel which was to be found in Scotland. He thought that pitching was, to a great extent, caused by the dips in the hydraulic main being really below what they should be. As to stopped ascension-pipes, if they were properly cleaned out each charge, there should be no trouble in this way. It was only when they were neglected, or the carbon or sooty matter was allowed to gather on the first 18 inches of the retort, that there was any trouble.

Mr. W. SMITH (Melrose) said he had listened with great attention to what had been said. With reference to the stopping of ascension-pipes, it occurred to him that the cause of this might be that they were too small. He had often been troubled in this way, when working with high heats; but when using low heats, he had never had any such difficulty. He thought that Mr. Blair did well in getting up to 11,000 cubic feet of gas per ton of coal; if he (the speaker) could do this, he would have a more favourable balance-sheet at the end of the year.

Mr. G. TAYLOR (Jedburgh) remarked that, like Mr. Blair, he had a baffle-plate in his hydraulic main; and he was never troubled with pitching. He found that, if the pipes were slanting in a certain direction, there might be thick tar, not pitch; but that, if they were put right, this went away. He thought that if the hydraulic main were too close to the bench, it might cause pitching. He found steam to be of very great benefit. One winter he had to pump a trap regularly. He put a steam-pipe down, and it cleared it at once, though it was pitched up very much.

The PRESIDENT said he quite agreed with one or two of the remarks Mr. Blair had made. He recollected once, in Ireland, he had three retorts working and three lying off; he started these three, and his gauge went up dreadfully. There was a sort of tarry matter gathered at the bottom of the dip-pipes, but no pitch; and he must say that, through all his experience, he had never had any difficulty with pitch in his hydraulic main. But he could not agree with Mr. Blair in regard to ascension-pipes. Ever since he had been at Duns, he had had great trouble with them in the dead of winter. When he had to use a high heat, to force matters, he was badly troubled—not with pitch, but with a thick sort of tar. It occurred at the very top of the cap, just before entering the hydraulic main. The pipes were always clear at the bottom.

Mr. BLAIR said he would recommend that there should be a cross current of ventilation at the level of the top of the retort-bench.

The HON. SECRETARY thought they might get a little nearer to the point. Mr. Young's difficulty, if he understood it aright, was not so much with the quantity of gas which was being taken off per ton of coal. It was rather the quantity the coal was capable of producing; and that immediately they began to distil the condensable hydrocarbons they had a choke. They were bound to have. At Selkirk, where they had fairly good settings, they could, with Newbattle cannel, for example, obtain 11,500 cubic feet of gas per ton. This was quite an ordinary make. But if they attempted to obtain 11,000 cubic feet from (say) Meiklehill, or any of the common coals, they had chokes immediately. Now, in Mr. Young's case, he had excellent heats, and the coals were all new to him; and his (the speaker's) opinion was that the trouble was due to coom. The reason he took such an interest in this matter was that he had chokes from the very same reason as Mr. Young had. He had drawn out ropes of pitch about 18 inches long, when using English coal at high heats; but whenever he used Scotch coal mixtures, getting the same satisfactory results from the coal carbonized, he had no stoppages. He believed that in every case, provided the plant was of the proper size, stoppages were due to over-distillation of the coal. They could not expect to take so much gas from an ordinary coal as from a rich cannel.

Mr. VASS supposed that Mr. Young did not mean them to understand that he was troubled with pitch in the proper sense of the word, but with thick tar. He himself was troubled with tar accumulating to such an extent that it would not blow by the ordinary valve. The valve was arranged so that the tarry matter should be drawn from the main first, and should leave only liquor in the main. In this particular case, the gas outlet was at the top of the main. The tarry matter got so thick that it would not flow; and they were troubled with back-pressure. He considered that the trouble was due to heat radiated from the bench. There would be about 18 inches between the top of the bench and the bottom of the hydraulic main; and the arches of the ovens had been made particularly light, as it was thought that they would rise and fall much easier, and would thereby have greater durability. The crowns of the arches would be about a brick and a half thick. They had to bore the end of the main, and steam the tar, in order to run it off. Now, if they found that there was the least tendency to pitch, they put steam through for about five minutes; and to get rid of the radiated heat, they placed a course of loose bricks along the edges of the bench, and filled in sand, leaving about a foot of space between the top of the sand and the hydraulic main. With this, and occasional steaming, they had been able to keep the main practically clear. He agreed with Mr. Blair in the matter of ventilating the retort-house. During the first winter he was in Portobello, they had a very close retort-house; and every night they had choked pipes. That winter he had enough to do to keep his men working, as they threatened to leave on account of the choking of the pipes. He had since changed the position of the bench. There was now much better ventilation in the retort-house; and there were not so many choked pipes.

Mr. J. C. ADAMSON thought that, somehow or other, the conversations at their meetings were perhaps more productive of good to the younger gas managers than what took place in the larger Gas Associations, where subjects which, to those in large works, seemed trifling did not engage full attention. As a manufacturer of plant for gas making, he might say that they had the advantage of coming into contact with all varieties of apparatus—for each gas manager sought to devise something to carry out his own ideas—and in this way they gathered a more universal knowledge of what was best adapted for the purpose. His experience was that the baffle-plate in hydraulic mains was almost universally used now; and so far as he knew, it had never failed in its object. He would suggest to their minds something which had not been referred to. He did not know if it had been observed by any of them that the manner in which the ascension-pipe was placed had sometimes to do with the choking of it. Supposing the ascension-pipe were inclined, as it went up, towards the retort-bench, the radiated heat from the bench would strike the side of the pipe down which the condensable matter was running, and there would be, more or less, a re-distillation of these products, leaving solid matter behind, adhering to the pipe, and tending to choke it up. If, on the other hand, the ascension-pipe lay away from the bench as it went up, the condensable matter would run down the cold side

of the pipe, and would not be affected by the radiated heat. He did not say that this would take place in every retort-house, because, where they had the cross currents Mr. Blair had spoken of, they would help to a great extent to neutralize the effect of the radiated heat.

Mr. TAYLOR said he could corroborate Mr. Adamson's statement. In his place, the ascension-pipes all hung out at the top. They had been in position for seventeen years; and there had never been a choke in an up-pipe, though there had been in a cross-pipe.

The PRESIDENT expressed his pride that his address had led to such a good discussion, and thanked them all for the way in which it had been received. While Mr. Adamson was speaking about the lie of the ascension-pipes, he was thinking of his own retort-house; and he recollected that the pipe which had troubled him most lay inwards to the bench at the top. The cross-pipe had been cut too short; and the ascension-pipe had been given an inward slant to suit it.

CONCLUDING BUSINESS.

The question of the next place of meeting was then considered; and it was resolved that, while no hard-and-fast rule should be adopted as to the holding of the spring meetings in Edinburgh, the meeting in April of next year should be held there, and that the meeting in September of next year should be held in Melrose—the date in each case to be, as usual, the second Thursday of the month.

The PRESIDENT asked for information regarding the insurance of gas-works against fire or accident; and several members informed him as to the rates which they were charged. The rates vary according to the class of risks, and average from 4s. to 4s. 6d. per £100.

This concluded the business of the meeting.

The dinner was afterwards held in the same hotel—Mr. M'Laren presiding.

THE ORIGIN OF GAS ASSOCIATIONS.

Mr. J. C. ADAMSON (Airdrie), in proposing the toast of "The Waverley Association of Gas Managers," said that the Waverley Association was the parent of all the Gas Associations or Gas Institutes in the country, and so far as he knew in the world. He congratulated the gas managers of to-day on living in such peaceful times. It was not always so. There was once a man named George Flintoff (whose death was noticed some two or three years ago in the "JOURNAL OF GAS LIGHTING"), who was possessed of a voluble tongue, and having agitated the gas consumers and others in several towns in England, with more or less success, he thereafter turned his attention to Scotland, where he arrived about the year 1860, and commenced a crusade similar to that which he had been carrying on in England. Not long ago he came across a printed bill which he held in his hand. It had been published by a Committee which Flintoff had succeeded in forming in Denny in July 1860. In the bill the Committee announced "the engagement of George Flintoff, Esq., the Gas Engineer from London, who has exposed gas abuses and saved more than £250,000 [not of capital but] a year to the gas consumers of a number of towns," and who was to "deliver a lecture on the Sale of Gas Bill and the various meter frauds practised upon the public." He succeeded in Denny as he also did in some other towns in Scotland in inducing a number of people to back him in the formation of a Consumers' Company and in the planting of a gas-works. From the West of Scotland he was working his way eastwards; and he arrived, if he (Mr. Adamson) remembered aright, in Dalkeith, where the late Mr. John Young was Gas Manager and already a veteran in the gas world—the father of Mr. William Young, of Peebles. Mr. Young tackled Flintoff in debate on the public platform in Dalkeith and elsewhere; and by an exposure of many of his misstatements he sought to hold the fort for the gas profession, to whom Flintoff was by his agitation causing injury. At that time coal was dear, and gas plant and gas knowledge not in such an advanced stage of perfection as it was to-day, and there might be some defects, from which a person who was seeking to raise an agitation might possibly find some help. At that time the late Mr. Robson, the Gas Manager of Selkirk, and himself—then Gas Manager at Galashiels—were in the practice of meeting at each other's houses on alternate Saturday evenings over a social cup of tea. In talking over the burning gas question of the hour, either Mr. Robson or himself, he forgot which, put forward the question, could nothing be done to stem the tide of this agitator who was causing such trouble and annoyance to gas managers. The suggestion then arose between them, that a Gas Managers' Association should be formed for mutual advice and help. Mr. Robson sent out invitations to the gas managers in the Waverley District, convening a meeting in Kelso. Some eight managers were present; and the Waverley Association of Gas Managers was duly formed, with Mr. Clazy, of Kelso, as the first President, and himself as the first Secretary. Mr. Mackenzie, then Manager of the Cupar-Fife Gas-Works, and afterwards of Dunfermline, was a gentleman to whom he (the speaker) had been indebted; having been his apprentice-master when he was qualifying himself for a gas managership. When writing to him, as he did regularly at that time, he told him of the Association the gas managers of the South of Scotland had formed. Mr. Mackenzie at once adopted the idea as a good one for his district; and he and his nearest neighbour Gas Manager, Mr. John Loudon, of Ceres, took the necessary steps which resulted in the formation of the Fife and Kinross Association. This afterwards merged into the Scottish Association; and from this afterwards arose the West of Scotland Association. And now all these were merged in the North British Association. He was glad that the Waverley Association maintained intact the individuality of their Association which was the parent of all other Associations; and he hoped that they would long live and flourish. He was glad to meet that day as he had done, when living in Galashiels in the early sixties, so many kind hearts among the gas managers of the Border towns; and he trusted they would go on meeting for many years to come, and find both profit and pleasure in each other's company. He had been asked to couple the toast with the name of their present respected Secretary, Mr. M'Lusky; and he thought that nothing could be more appropriate than that he—the Secretary of about 40 years ago—in proposing the Waverley Association, should couple it with the enterprising Secretary of the present time.

The members and their friends afterwards drove to Manderston House, the seat of Sir James Miller, Master of the Berwickshire Foxhounds, which they had received permission to visit, and where they were privileged to witness the garden and the hunting arrangements. The weather was favourable for the outing, which was much enjoyed.

THE MEETING OF THE BRITISH ASSOCIATION.

Sir W. Crookes on Nitrate of Soda as a Fertilizer, and the Fixation of Atmospheric Nitrogen.

For the third time in its history, the British Association has met in Bristol. The destruction of the Colston Hall by fire almost on the eve of the meeting might have occasioned serious inconvenience in a town less richly equipped than Bristol with spacious scholastic and other establishments, suitable for gatherings of the immensity of that which assembled last week. Happily the city was lavish in its generous hospitality; and there was no deficiency in the requisite accommodation. The Council of the Association fitly recognized this liberality of the authorities by making a grant of £120 from their funds in order to assist in alleviating the great misfortune which has befallen the town.

The formal inauguration of the meeting took place on Wednesday in the People's Palace—the retiring President, SIR JOHN EVANS, occupying the chair at the commencement of the proceedings. In resigning his position, Sir John said it was hardly necessary for him to introduce his successor, Sir William Crookes; for his name was known throughout the civilized world. At an early age, he attained great eminence in chemistry. But he had not confined himself to chemical research, for he had experimented largely on various materials *in vacuo;* and the Crookes tube was known throughout the world. These experiments led to more important results than the radiometer. From them had risen the Röntgen rays; and they might look to Sir W. Crookes as the real originator of the rays, which were now so extensively employed.

Sir WILLIAM CROOKES then proceeded to read his address; and the first and chief subject dealt with was that of food supply. By means of numerous figures and arguments, he sought to show that our wheat-producing soil is totally unequal to the strain put upon it, and that the way out of the colossal dilemma which would ultimately present itself would be through the chemist. The address then proceeded: Before we are in the grip of actual dearth, the chemist will step in and postpone the day of famine to so distant a period that we, and our sons and grandsons, may legitimately live without undue solicitude for the future. It is now recognized that all crops require what is called a "dominant" manure. Some need nitrogen, some potash, others phosphates. Wheat pre-eminently demands nitrogen, fixed in the form of ammonia or nitric acid. All other necessary constituents exist in the soil; but nitrogen is mainly of atmospheric origin, and is rendered "fixed" by a slow and precarious process which requires a combination of rare meteorological and geographical conditions to enable it to advance at a sufficiently rapid rate to become of commercial importance.

There are several sources of available nitrogen. The distillation of coal in the process of gas-making yields a certain amount of its nitrogen in the form of ammonia; and this product, as sulphate of ammonia, is a substance of considerable commercial value to gas companies. But the quantity produced is comparatively small. All Europe does not yield more than 400,000 annual tons; and, in view of the unlimited nitrogen required to substantially increase the world's wheat crop, this slight amount of coal ammonia is not of much significance. For a long time guano has been one of the most important sources of nitrogenous manures; but guano deposits are so near exhaustion that they may be dismissed from consideration. Much has been said of late years, and many hopes raised by the discovery of Hellriegel

and Wilfarth, that leguminous plants bear on their roots nodosities abounding in bacteria endowed with the property of fixing atmospheric nitrogen; and it is proposed that the necessary amount of nitrogen demanded by grain crops should be supplied to the soil by cropping it with clover and ploughing in the plant when its nitrogen assimilization is complete. But our present knowledge leads to the conclusion that the much more frequent growth of clover on the same land, even with successful microbe-seeding and proper mineral supplies, would be attended with uncertainty and difficulties. The land soon becomes what is called "clover sick," and turns barren. There is still another and invaluable source of fixed nitrogen. I mean the treasure locked up in the sewage and drains of our towns. Individually the amount so lost is trifling; but multiply the loss by the number of inhabitants, and we have the startling fact that in the United Kingdom we are content to hurry down our drains and watercourses, into the sea, fixed nitrogen to the value of no less than £16,000,000 per annum. This unspeakable waste continues; and no effective and universal method is yet contrived of converting sewage into corn. Of this barbaric waste of manurial constituents Liebig, nearly half a century ago, wrote in these prophetic words: "Nothing will more certainly consummate the ruin of England than a scarcity of fertilizers—it means a scarcity of food. It is impossible that such a sinful violation of the divine laws of Nature should for ever remain unpunished; and the time will probably come for England sooner than for any other country, when, with all her wealth in gold, iron, and coal, she will be unable to buy one-thousandth part of the food which she has, during hundreds of years, thrown recklessly away." The more widely this wasteful system is extended, recklessly returning to the sea what we have taken from the land, the more surely and quickly will the finite stocks of nitrogen locked up in the soils of the world become exhausted. The store of nitrogen in the atmosphere is practically unlimited; but it is fixed and rendered assimilable by plants only by cosmic processes of extreme slowness. The nitrogen which with a light heart we liberate in a battleship broadside has taken millions of minute organisms patiently working for centuries to win from the atmosphere.

The only available compound containing sufficient fixed nitrogen to be used on a world-wide scale as a nitrogenous manure is nitrate of soda, or Chili saltpetre. This substance occurs native over a narrow band of the plain of Tumarugal, in the northern provinces of Chili, between the Andes and the coast hills. In this rainless district for countless ages, the continuous fixation of atmospheric nitrogen by the soil, its conversion into nitrate by the slow transformation of billions of nitrifying organisms, its combination with soda, and the crystallization of the nitrate have been steadily proceeding, until the nitrate fields of Chili have become of vast commercial importance, and promise to be of inestimably greater value in the future. The growing exports of nitrate from Chili at present amount to about 1,200,000 tons. The present acreage devoted to the world's growth of wheat is about 163 million acres. At the average of 12·7 bushels per acre, this gives 2070 million bushels. But thirty years hence, the demand will be 3260 million bushels; and there will be difficulty in finding the necessary acreage on which to grow the additional amount required. By increasing the present yield per acre from 12·7 to 20 bushels, we should with our present acreage secure a crop of the requisite amount. Now from 12·7 to 20 bushels per acre is a moderate increase of productiveness; and there is no doubt that a dressing with nitrate of soda will give this increase and more.

The action of nitrate of soda in improving the yield of wheat has been studied practically by Sir John Lawes and Sir Henry Gilbert on their experimental field at Rothamstead. This field was sown with wheat for thirteen consecutive years without manure, and yielded an average of 11·9 bushels to the acre. For the next thirteen years it was sown with wheat, and dressed with 5 cwt. of nitrate of soda per acre, other mineral constituents also being present. The average yield for these years was 36·4 bushels per acre—an increase of 24·5 bushels. In other words, 22·86 lbs. of nitrate of soda produced an increase of one bushel of wheat. At this rate, to increase the world's crop of wheat by 7·3 bushels, about 1½ cwt. of nitrate of soda must annually be applied to each acre. The amount required to raise the world's crop on 163 million acres from the present supply of 2070 million bushels to the required 3260 million bushels will be 12 million tons distributed in varying amounts over the wheat-growing countries of the world. It is difficult to get trustworthy estimates of the amount of nitrate surviving in the nitre-beds. Common rumour declares the supply to be inexhaustible; but cautious local authorities state that at the present rate of export, of over one million tons per annum, the raw material "caliche," containing from 25 to 50 per cent. nitrate, will be exhausted in from twenty to thirty years. Dr. Newton, who has spent years on the nitrate-fields, tells me there is a lower class material, containing a small proportion of nitrate, which cannot at present be used, but which may ultimately be manufactured at a profit. Apart from a few of the more scientific manufacturers, no one is sanguine enough to think this debateable material will ever be worth working. If we assume a liberal estimate for nitrate obtained from the lower grade deposit, and say that it will equal in quantity that from the richer quality, the supply may last, possibly, fifty years, at the rate of a million tons a year; but at the rate required to augment the world's supply of wheat to the point demanded thirty years hence, it will not last more than four years.

For years past we have been spending fixed nitrogen at a culpably extravagant rate, heedless of the fact that it is fixed with extreme slowness and difficulty, while its liberation in the free state takes place always with rapidity and sometimes with explosive violence. There is a gleam of light amid this darkness of despondency. In its free state nitrogen is one of the most abundant and pervading bodies on the face of the earth. Every square yard of the earth's surface has nitrogen gas pressing down on it to the extent of about 7 tons. But this is in the free state; and wheat demands it fixed. To convey this idea in an object lesson, I may tell you that, previous to its destruction by fire, Colston Hall, measuring 146 ft. by 80 ft. by 70 ft., contained 27 tons weight of nitrogen in its atmosphere; it also contained one-third of a ton of argon. In the free gaseous state, this nitrogen is worthless; combined in the form of nitrate of soda, it would be worth about £2000. For years past attempts have been made to effect the fixation of atmospheric nitrogen; and some of the processes have met with sufficient partial success to warrant experimentalists in pushing their trials still further. But I think I am right in saying that no process has yet been brought to the notice of scientific or commercial men which can be considered successful either as regards cost or yield of product.

The fixation of atmospheric nitrogen, therefore, is one of the great discoveries awaiting the ingenuity of chemists. The fixation of nitrogen is vital to the progress of civilized humanity; and it is a question of the not far distant future. Let me see if it is not possible even now to solve the momentous problem. As far back as 1892 I exhibited, at one of the *soirées* of the Royal Society, an experiment on the flame of burning nitrogen. I showed that nitrogen is a combustible gas; and the reason why, when once ignited, the flame does not spread through the atmosphere and deluge the world in a sea of nitric acid, is that its igniting point is higher than the temperature of its flame—not, therefore, hot enough to set fire to the adjacent mixture. But by passing a strong induction current between terminals, the air takes fire, and continues to burn with a powerful flame, producing nitrous and nitric acids. This inconsiderable experiment may not unlikely lead to the development of a mighty industry, destined to solve the great food problem. With the object of burning out nitrogen from air so as to leave argon behind, Lord Rayleigh fitted up apparatus for performing the operation on a larger scale, and succeeded in effecting the union of 29·4 grammes of mixed nitrogen and oxygen at an expenditure of 1-horse power. Following these figures, it would require one Board of Trade unit to form 74 grammes of nitrate of soda; and therefore 14,000 units to form one ton. To generate electricity in the ordinary way with steam-engines and dynamos, it is now possible, with a steady load night and day, and engines working at maximum efficiency, to produce current at a cost of ¼d. per Board of Trade unit. At this rate, one ton of nitrate of soda would cost £26. But electricity from coal and steam-engines is too costly for large industrial purposes. At Niagara, where water power is used, electricity can be sold at a profit for ⅓d. per unit. At this rate, nitrate of soda would cost not more than £5 per ton. But nitrate of soda is limited in quantity, and will soon be exhausted. Human ingenuity can contend even with these apparently hopeless difficulties. Nitrate can be produced artificially by the combustion of the atmosphere. Here we come to finality in one direction; our stores are inexhaustible. But how about electricity? Can we generate enough energy to produce 12 million tons of nitrate of soda annually? A preliminary calculation shows that there need be no fear on that score; Niagara alone is capable of supplying the required electric energy without much lessening its mighty flow. The future can take care of itself. The artificial production of nitrate is clearly within view, and by its aid the land devoted to wheat can be brought up to the 30 bushels per acre standard. In days to come, when the demand may again overtake supply, we may safely leave our successors to grapple with the stupendous food problem. And in the next generation, instead of trusting mainly to foodstuffs which flourish in temperate climates, we probably shall trust more and more to the exuberant foodstuffs of the tropics, where, instead of one yearly sober harvest, jeopardized by any shrinkage of the scanty days of summer weather, or of the few steady inches of rainfall, Nature annually supplies heat and water enough to ripen two or three successive crops of foodstuffs in extraordinary abundance.

Several other subjects which are engaging the attention of the scientific world were treated upon in the address; but they are beyond the scope of the "JOURNAL."

At the close of his eloquent discourse, the President was heartily thanked by the ladies and gentlemen, numbering about 2000, who had had the privilege of hearing its delivery.

A Convention of Acetylene Gas Manufacturers was recently held in the Great Northern Hotel, Chicago, at which fifteen firms were represented. A number of officials were elected; and it was decided to send to all acetylene gas manufacturers in the United States a copy of the minutes of the Convention, with an invitation to apply for membership.

THE ACTION OF LIGHT ON ACETYLENE.

Some time ago Messrs. William A. Bone and John Wilson noticed that acetylene undergoes a well marked change on exposure to bright sunlight; and in view of the fact that the use of this gas as an illuminant is being advocated, says the "Electrical Review," they determined to investigate the change. At a meeting of the Chemical Society held on June 16, they described the results which they had so far obtained; and we commend them to those who are endeavouring to exploit this new illuminant, especially since some of the lamps in which it is used are made of glass, which is, of course, transparent. We know perfectly well, our contemporary observes, that under the ordinary conditions in which an acetylene lamp would be employed, sunlight is not available; but we have never heard that these lamp reservoirs are kept in the dark until the moment they are required for use. The subject is of sufficient importance to warrant a somewhat fuller abstract than usual of the chemical methods employed in determining the change which acetylene undergoes.

Tubes of about 100 cc. capacity, drawn out at each end and terminated by capillary glass taps, were filled at atmospheric pressure with pure acetylene prepared from copper acetylide, and dried by passing through a concentrated solution of potassium hydroxide. Some of these tubes were exposed on the roof of the laboratory throughout June and July of last year, when the weather was particularly fine. After two or three days' exposure, a faint brown deposit was observable on the inside of the bulbs. This gradually increased in extent and thickness until, at the end of a fortnight, the tubes were entirely covered with a dark brown, greasy deposit. The change was evidently due to the action of sunlight; for if a portion of the tube were screened from the light, no deposit was formed over the area so protected, and, further, after the tube had become coated with the opaque deposit, no further action was noticeable even after prolonged exposure. Acetylene was decomposed to a less extent when exposed in tubes during August and September, 1897, than during the previous two months. The decomposition is independent of the presence of air, because acetylene mixed with its own volume of oxygen or nitrogen was exposed to sunlight for a very long period without any appreciable change occurring. A slight contraction in volume was observed when tubes exposed during last summer were opened over mercury. A measured quantity of the gas sent into a Hempel pipette containing a freshly prepared ammoniacal solution of cuprous chloride was quickly reduced to about 2 per cent. of its original volume. The residual gas, after treatment with dilute sulphuric acid, appeared to contain a fairly dense hydrocarbon absorbed by fuming sulphuric acid, mixed possibly with a small quantity of hydrogen. No saturated hydrocarbon could be detected. The solid deposit on the side of the tube was removed by treatment with fuming nitric acid, in which it does not dissolve to any appreciable extent. On removal of the acid filtration, irregular yellow plates remained. The acid filtrate was carefully tested for the presence of nitro-derivatives of benzene and naphthalene, but without success. The yellow plates were insoluble in hot benzene, and could be heated at 270° without melting or undergoing any change. They apparently consisted of a very dense hydrocarbon or hydrocarbons.

Messrs. Bone and Wilson are working this summer on larger volumes of acetylene; and they hope eventually to determine the nature of the products obtained during its decomposition under the influence of sunlight. It is conceivable that they may discover that these products are capable of exercising a dangerous influence; and we are quite sure that even the most ardent advocates of acetylene will welcome fuller information on this subject.

WIND PRESSURE ON EXPOSED STRUCTURES.

Sir J. Wolfe Barry was the President of the Mechanical Science Section at the meeting of the British Association last week; and on Thursday he delivered his Inaugural Address. In one part of it, he instanced how hasty generalizations were sometimes responsible for unnecessarily increasing the anxieties of engineers and arousing public alarm. Following this up, he spoke of the danger of "hasty generalization" in connection with the important question of wind pressure; and his remarks on this point will be of much interest to constructing engineers generally. He said:

Tredgold, who undoubtedly was one of the soundest of engineers, laid down in 1840 that a pressure of 40 lbs. per square foot should be provided for—reasoning, no doubt, from the fact that such a pressure had in this country been registered on a wind-gauge of a square foot or less in area. As a consequence, he assumed that the same force could be exerted by the wind on areas of any dimensions. Thus roofs and bridges, wherever any calculations of wind pressure were made, were designed for a pressure of 40 lbs. per square foot of the whole exposed surface. Under the alarm caused by the fall of the Tay Bridge in 1879, the piers of which were not probably strong enough to resist a horizontal pressure of one-fifth of such an amount, a further general assumption was made, and railway bridges throughout the kingdom were ordered by the Board of Trade in 1880 (acting no doubt on expert advice) to be in future designed, and are designed to this day, to resist 56 lbs. of horizontal wind pressure on the whole exposed area, with the ordinary factors of safety for the materials employed, as if such horizontal strain were a working load.

It had, for a long time previously to this order of Government being issued, been suspected that these small gauge experiments were untrustworthy; and subsequent experiments at the Forth Bridge on two wind-gauges of 300 square feet and of 1½ square feet respectively indicated that with an increase of area, the unit of pressure fell off in a very marked degree. Under the same conditions of wind and exposure, the larger gauge registered a pressure 38 7 per cent. less per square foot than the smaller gauge. I have been able to carry experiments further at the Tower Bridge, by observing the pressure on the surface of the bascules of the bridge as evidenced by the power exerted by the actuating engines. In this case, we have a wind-gauge of some 5000 feet in area; and it has been shown that, while small anemometers placed on the fixed parts of the bridge adjoining the bascules register from 6 lbs. to 9 lbs. per square foot, the wind pressure on the bascules is only from about 1 lb. to 1½ lbs. per square foot. It is difficult to imagine the amount of money which has been wasted in unnecessary provision against wind strains of 56 lbs. per square foot on large areas, in consequence of this hurried generalization from insufficient data. I know something of what the provision for 56 lbs. on the square foot for wind cost at the Tower Bridge; and I do not wish to mention it. But if the public had been told that the dictum of experts, arrived at however hastily in 1880, was to be set aside in the construction of that bridge, all confidence would have been beforehand destroyed in it; and I suppose no Committee of Parliament would have passed the Act.

I have mentioned these matters, which could be added to by many similar instances in other branches of applied science, not for the sake of reviving old controversies or of throwing a stone at highly-distinguished men, honoured in their lifetime, and honoured in their memory, nor for the sake of criticizing more modern scientists or a Government department. Still less do I wish to question the necessity and value of mathematical calculations as applied to the daily work of engineering science; but I recall the circumstances for the purpose of bespeaking the utmost caution against our being tempted to lay down laws based on unascertained data. We know the tendency there has been at all times to generalize and to seek refuge in formulæ; and we cannot but know that it is not at an end now. We ought to recognize and remember how few physical questions had been exhaustively examined sixty years ago, and, may I say, how comparatively few have even now been fundamentally dealt with by experiment under true scientific conditions? The investigation of physical facts under all the various conditions which confront an engineer requires much care, intelligence, time, and last, not least, not a little money. In urging the vital necessity of investigations, I am sure that I shall not be understood as decrying the value of the exact analysis of mathematics; but we must be quite sure that the premises are right before we set to work to reason upon them. We should, then, exert all our influence against rules or calculations based merely on hypothesis, and not be content with assumptions when facts can be ascertained, even if such ascertainment be laborious and costly.

New Loan Sanctioned for the Heywood Gas Undertaking.—The Chairman of the Gas Committee (Mr. A. C. Maden) reported to the Heywood Town Council last Thursday that the Local Government Board had sanctioned the borrowing of £8000 for gas-works purposes. The Committee asked for permission to borrow £10,000; and the Board had granted them power to borrow £8000, to be repaid in 25 years. The Committee thought that this was very satisfactory. Of the amount named, £1500 was required for land, £2000 for prospective new mains, £3000 for stoves and prepayment meters; a new coke-breaking machine would take a large part of £600; and £900 was being spent in buildings for stores, &c.

Burnley Corporation Gas Supply.—The annual report of the Burnley Corporation Gas Engineer (Mr. J. P. Leather) has just been published, together with those from officials in the other departments. He states that the increased gas consumption for the year was 6,118,000 cubic feet; or 1·36 per cent. In the previous twelve months, the increase was 3·6 per cent.; and he attributed the falling off to depression in trade, which was very pronounced in the cotton industry last winter. The largest consumption in one day was 2,700,000 cubic feet, as compared with 2,704,000 cubic feet in the preceding twelve months. There were 1898 public lamps in use, an increase of 80 on the year; and they consumed 38,008,000 cubic feet of gas, having been lighted 3583 hours. The quantity of coal and cannel carbonized was 46,259 tons; and the gas made and sold per ton, compared with the three previous years, was: 9818 cubic feet made and 9303 feet sold in 1898; 9766 feet made and 9307 feet sold in 1897; 9812 feet made and 9220 feet sold in 1896; and 9425 feet made and 9012 feet sold in 1895. The Engineer adds that the Committee decided recently to fix free of charge small breakfast cookers with prepayment meters; and a considerable demand was now being made for them—about 400 being in use. The business in gas-stoves was 66 cookers and 68 gas-fires sold direct, and 226 cookers and 16 gas-fires on the hire-purchase system. The cookers on simple hire had decreased by 19; gas-fires had increased by 11.

REGISTER OF PATENTS.

Gas-Main Stoppers.—Goodman, P., of New York. No. 22,864; Oct. 5, 1897.

This invention relates to a device intended to temporarily stop a gas-main. It is constructed (as shown) of two flat steel springs, which have eyes at their ends adapted to receive a pivot pin. The springs are pivoted at each end to two rods; the one being a tube receiving the other, and thus telescoping. The springs are slightly bent or curved throughout their length, but capable of compression so that they may be forced closely to the centre against the rods. Outside the springs is provided some form of elastic packing—such as a rubber tube. Outside of the tube, and enclosing within it the springs, is a casing to which is attached a flexible diaphragm of cloth, leather, or any similar material, treated, if necessary, in such a manner as to make it, for all practical purposes, impervious to gas. The diaphragm is made in the direction of the sliding rods larger than the diameter of the pipe to which the device is to be applied. In the other direction it is made so that it will be drawn tight when the sides are separated, so as to fit against the interior surface of the pipe. The sliding rods have handle-bars jointed thereto just inside of their outer ends, and bent near their points of attachment so that they will pass rearward and clear of the spring bars and their packing.

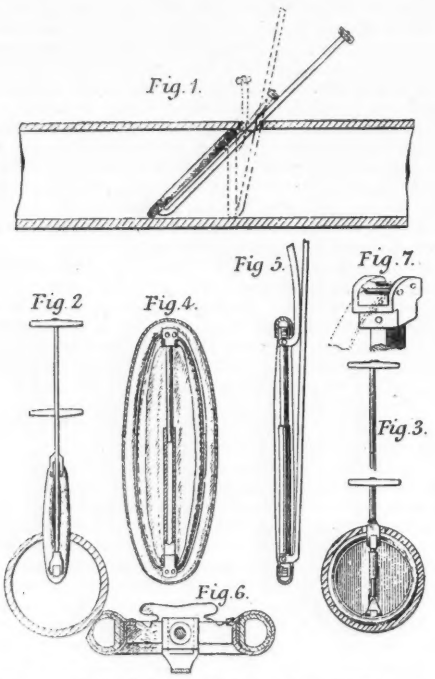


Fig. 1 shows the device being applied to a pipe; fig. 2 is a cross section of the pipe, showing the device inserted through a hole in the side; fig. 3, is a similar view, with the device in position; fig. 4 is an enlarged detail of the ring or stopper proper, showing the casing surrounding the tube or packing; fig. 5 is a longitudinal section taken through the ring at one side of the sliding bars; fig 6 is a cross section; and fig. 7, a perspective detail, showing the end of one of the sliding bars and the pivotal connection of the springs thereto.

When the device is to be used, a hole is made in the gas-pipe or main; and the sides of the device are brought close together and inserted through the hole. The device will, when first inserted, occupy an angular position; and it is so inserted that the ring will be next to the source of gas supply. This leaves the ring to fit against the interior surface of the pipe entirely at one side of the entrance hole. While in this position, one handle is held firmly, while the ring is compressed by drawing upon the other handle, at the same time that the handle-bars are brought to an upright position. In this way, the springs are forced outward until the ring assumes a circular form pressing closely against the interior surface of the pipe.

Self-Igniting Mantles for Incandescent Gas-Burners.—Stoecklin, L., of Mulhausen, Germany. No. 6860; March 21, 1898.

The patentee proposes to treat the mantle, before it is burned in the well-known manner, with a platinum salt solution, in an alkaline bath (ammonia, soda, or potash-lye), whereby the material of the mantle is "acted upon chemically in such manner that the mantle is rendered capable of taking up the necessary quantity of platinum salt in order to produce self-ignition, without its solidity being thereby deteriorated."

The detailed procedure is as follows: The mantle, ready prepared with thorium nitrate, cerium nitrate, and the like incandescent salts and dried, as found on the market—that is, before being burned—is saturated with an alkaline solution of ammonia, potash, or soda-lye, preferably with an alcohol ammoniacal or alcohol alkaline solution. This preliminary treatment has the effect of depositing the incandescence oxides in a form insoluble in water, upon and in the fibres of the mantle; and without this treatment it would be impossible to produce upon the mantle a platinum-black deposit which would not chip off at once after the burning process. The mantle is next well washed for some time in running water, in order to completely remove the superfluous alkali and the alkaline salts which have formed, and then thoroughly dried. The mantle is now ready to receive the platinum salt. For this purpose, it is dipped with its head into a concentrated solution of platinum or iridium, but only so far that the solution is absorbed up to the seam. The mantle is then introduced into an ammoniacal solution, in order to convert the platinum again into an insoluble platinum compound.

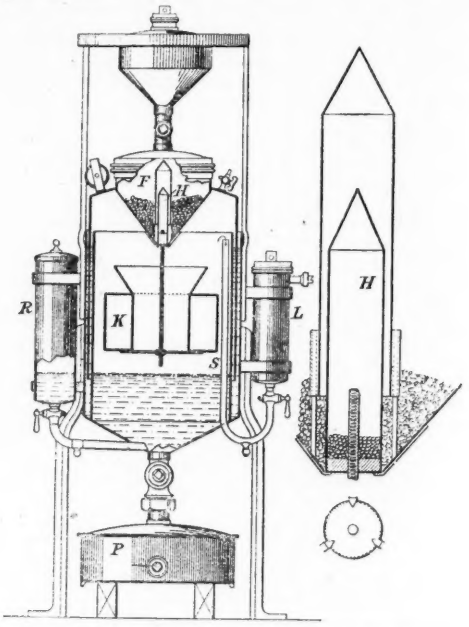
By this latter treatment, a double purpose is attained: First, the platinum salt is prevented from being soaked up too far, so that it may be taken up exactly to the desired height; the platinum salt being at once converted by the ammonia into an insoluble platinum compound. Second, the ammonia carries the acid of the salt with it, and thus effects afterwards a more homogeneous division and burning of the platinum. After this treatment with ammonia, the mantle is again washed in running water and dried.

Manufacture of Gas.—Wise, W. L.; a communication from A. Piatti and Co., of Rome. No. 8813; April 15, 1898.

This is a modification of the "invention" described in patent No. 2129 of 1897 [See "Journal," Vol. LXX., p. 1400]; and it consists in the substitution for colophony, of bitumen or bituminous substances, which give the same results as colophony, and cost much less. The procedure is the same as that described, except that bitumen or bituminous substances are employed in the same proportions in lieu of colophony.

Acetylene Gas-Generators.—Kieffer, F. A., of Paris. No. 11,261; May 17, 1898. Date claimed under International Convention, Dec. 11, 1897.

This invention relates to acetylene gas-generators, consisting essentially of a combination with a container for the carbide (carried by a bell or holder in which the gas is generated) of "a cylindro-conical valve, which is caused to be alternately opened and closed so as to admit and cut off the supply of carbide."



The illustration shows a vertical section of the whole apparatus, a vertical section of the valve connected with the float, and an underside plan of the carbide container in which the valve is mounted.

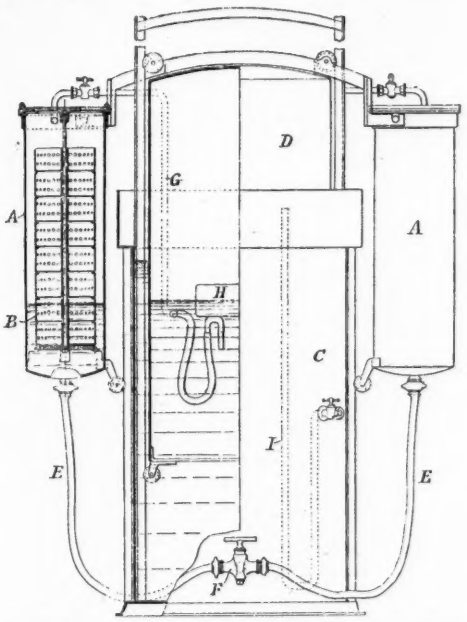
The bell or hollow cylinder shown is open at the bottom and closed at the top, and is inverted in an annular water seal between double walls of the tank. The bell is formed in one with the carbide container F, which communicates with a second supply-vessel from which carbide may be transferred to the container while the apparatus is in operation. Around the outlet of the container, are projections which support the tubular "cylindro-conical" valve H, which (weighted with shot) is capable of sliding vertically within a hood or tubular casing rising within the container. The valve is connected by a screw-threaded rod to an annular float K, having a funnel-shaped mouth leading to its central aperture. The tank, with its hopper-shaped bottom, communicates with a receptacle P provided with a discharge-cock R. Water is supplied to the tank from a reservoir; and the gas as generated passes away through a pipe S into a purifier L, whence it is supplied for consumption.

The following is the action of the apparatus: The containers having been filled with carbide, water is admitted to the receptacle R, and to the tank, until the desired level is reached, whereupon the cock is closed and the apparatus commences to act. At this moment the holder bell is in its lowest position, and the float K in contact with the water, so that the valve H is raised sufficiently to uncover the orifice of the container F, and allow a small quantity of carbide to drop into the water through the funnel-shaped mouth of the annular float. Upon the carbide coming in contact with the water, acetylene gas is generated, the pressure of which raises the holder bell together with the carbide container, which causes the valve H to close the outlet and cut off the supply of carbide. As the gas evolved passes away for consumption, the pressure in the bell is reduced, and it consequently falls together with the container F. During this downward movement of the bell, the valve H again rises under the action of the float K, so as to allow more carbide to drop into the water, when a fresh evolution of gas takes place. The bell then again rises and closes the outlet, and so on—thus automatically furnishing a supply of carbide proportionate to the consumption of gas.

Producing Acetylene.—Thompson, W. P.; a communication from H. Sez, of St. Denis, France. No. 14,197; June 27, 1898.

This apparatus for producing acetylene gas entails the use of two generators A, independent of one another, but both connected to one and the

same bell of the gasholder, from which they are externally suspended, and which carries them along with it in all its movements. Angular brackets serve to maintain a plate at a certain distance apart from the bottom; and upon this plate carbide boxes B are placed on top of one another. The boxes, which are formed with a solid base and a perforated periphery, are held in position by a rod secured to the plate. The holder consists (as usual) of a reservoir C, and a sliding bell D guided by friction-rollers, adapted to roll upon T-irons. The bell has a cross bar fixed upon its upper end, which terminates at each of its extremities in a hook so constructed as to embrace and support each of the gas-generators. Each generator is moreover guided at its lower part by a friction-roller adapted to roll upon a T-iron fixed upon the outer wall of the reservoir C. By this arrangement the generators are carried along by the moveable or sliding bell, and follow all its movements. The water for the reaction arrives at the lower part of the generator through flexible pipes E, connected to a single three-way cock F, arranged at the bottom of the reservoir. This cock, according to the position given to its plug, permits of it either feeding one single gas-generator or both of them, or of completely isolating the one and the other from the reservoir. The gas formed in each generator is carried off by the pipe G, which has its other end immersed in the reservoir. This end traverses the wall of the bell D, to which it is soldered, and terminates internally in a nozzle on which a flexible pipe is mounted connected to a bent tube directed towards the bottom, and carried by a float H. An identical arrangement is provided for the discharge of the gas from each generator; the bent tubes being either carried by a single float or by separate floats. A pipe I, terminating in a cock arranged upon the outside of the reservoir, serves to convey the gas from the interior of the bell, in order to pass it into the feed-conduits from which it is drawn.



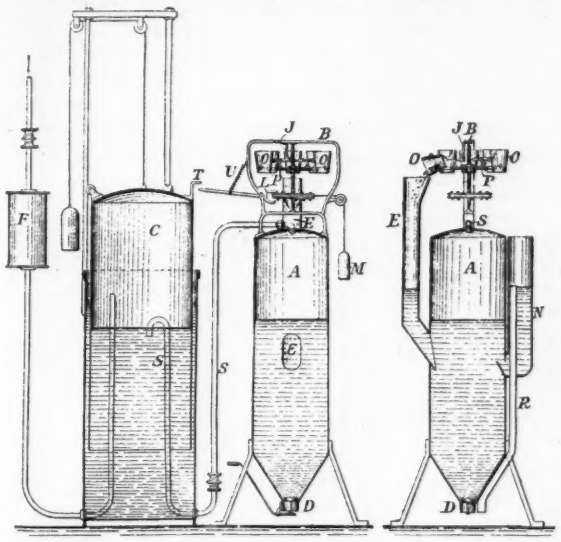
When in operation, after the reservoir C has been filled with water up to a suitable level, while the bell occupies its low position, the cock F is operated so as to place one of the generators in communication with the reservoir. Instantly the water-level existing in the reservoir has the tendency to be established in the gas-generator through the intermediary of the pipe E; but as soon as the water in its rising motion arrives in contact with the carbide contained in the lowest box C, acetylene is produced and discharged into the water of the reservoir, where it forms bubbles and subsequently arrives under the bell D, which latter it lifts. As the bell ascends, it carries the generator along with it; thus withdrawing the carbide from the action of the water. From this moment the water-level remains stationary under the bell; and the level in the generator is kept about at the same height. If, therefore, the consumption exceeds the production, the bell D, as well as the gas-generator, descends; and as the level remains constant, a fresh layer of carbide is attacked, and fresh gas produced. If this production exceeds the consumption, the bell rises together with the gas-generator, thus withdrawing the carbide contained in the latter from the action of the water. The operation thus proceeds in a regular manner, until the carbide contained in one of the generators is completely exhausted. All that is then necessary is to so operate the cock F as to place the reservoir in communication with the other generator which has been previously charged—isolating, of course, the gas-generator which has been working in order to re-charge the same. The production of gas can be thus continued indefinitely without interruption.

Generating Acetylene.—Lake, H. H.; a communication from La Compagnie Continentale d'Incandescence et de Chauffage, System Franck et Poitrimol, of Brussels. No. 14,713; July 4, 1898.

This apparatus consists of a generator A, adapted to be charged with the carbide of calcium from an automatic charging apparatus B, of a gas-holder C, and of a purifier F. The two last-named parts are of ordinary construction; and it is therefore only necessary to describe the generator and its charging apparatus.

The generator is of cylindrical form, standing on end and closed at the top; and it has at its lower end a conical or funnel-shaped portion, provided with an outlet-valve D. To one side of the cylindrical portion of the generator is fixed a pipe E rising above the generator, and formed with an enlarged mouth arranged in proximity with the charging apparatus B. This latter consists of a horizontally arranged carrier-plate P, firmly secured to a vertical spindle, and supporting a number of buckets O, distributed around its circumference, each of which contains a predetermined charge of carbide. The buckets, suspended by pivots, are capable of being tipped in order to discharge the carbide into the mouth of the pipe E. This tipping of the buckets may be effected either in a plane passing through the radius or in a plane at right angles, according to the form of bucket.

The buckets are so constructed as to have a tendency to tip automatically; and this may be effected either by placing the pivots out of centre or by weighting the front of the bucket. A pivoted catch is provided to automatically lock the buckets and retain them in their normal or upright position by engaging in an eye-piece on the buckets. The catch, together with the bucket held by it, revolves with the carrier-plate P; and they pass at the required moment beneath a fixed incline J, whereby they are disengaged from the bucket and allowed to tip forward so as to discharge the carbide with the mouth of the pipe E.



On the spindle, but below the carrier-plate P, is a pulley controlled by a rope, having a weight M, and passing over a guide-pulley. The tendency of this pulley is to revolve the entire charging apparatus; but its motion is checked by a pivoted and forked lever L, adapted to act against two series of pegs provided in the sides of the pulley. These pegs are so arranged as to permit of an angular movement of the pulley at each complete oscillation of the forked lever equal to the distance between two consecutive buckets. By this arrangement, each complete oscillation of the forked lever L causes one of the buckets O to arrive in close proximity to, and be discharged into, the pipe E. The lower end of this pipe extends into the interior of the generator, and so prevents gas-bubbles from rising vertically or by capillary action into the pipe.

The gas generated in the interior of the generator is balanced by a column of water contained in a vertical pipe N in communication with the generator, by an opening situated somewhat above that of the pipe E, and protected against the entrance of gas-bubbles by an inclined screen or shield. This pipe N is provided with an overflow-tube R, through which any excess of water from the generator is allowed to escape, while serving at the same time as a safety device for limiting the maximum pressure of gas in the generator.

The gas as generated flows through a bent tube S into the holder C, which is of sufficient capacity to receive the gas generated from a charge of carbide; the gas causing the bell of the holder to ascend with its uppermost position, and then to descend gradually in accordance with the consumption of the gas.

On the bell is secured a tappet T, so arranged as to strike against the tail-end of the forked lever L when the bell C reaches its lower position. It thereby causes a fresh charge of carbide to be discharged into the generator, whereupon the bell ascends again. The forked lever now being disengaged from the tappet T is returned to its former position by means of a spring U.

This method of charging repeatedly, and only in small quantities, permits of both the holder and the generator being of small size while yet being of a working capacity limited only by the number of buckets carried by the charging apparatus. These buckets may be arranged to be re-charged during the operation of the apparatus, in which case the operation is only interrupted for the purpose of removing through the plug or valve D the residues which accumulate in the lower part of the generator.

APPLICATIONS FOR LETTERS PATENT.

18,514.—Potter, W. G., "Gas-burners." Aug. 30.

18,515.—Potter, W. G., "Gas-governors." Aug. 30.

18,543.—Bildie, J., and Drivet, H., "Acetylene generators or lamps." Aug. 30.

18,575.—Edwards, F., and Frazer, J., "Generating and burning acetylene gas." Aug. 30.

18,591.—Quatannens-Moens, R., and Carreer-Dilger, E., "Production of acetylene gas." Aug. 30.

18,741.—Wise, W. L., "Generating and supplying acetylene gas." A communication from F. C. Wilson. Sept. 1.

18,768.—Riley, W., and Kershaw, A., "Oxygen gas generators and gasholders." Sept. 2.

18,770.—Riley, W., and Kershaw, A., "A new or improved gasholder." Sept. 2.

18,835.—Bond, E. S., "Acetylene gas apparatus." Sept. 3.

18,854-5.—Evans, A. F., "Internal combustion engines." Sept. 3.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

The Local Government Board and the Protection of Water Supplies from Pollution.

Sir,—All water engineers will be grateful to Mr. Percy Griffith for bringing to the notice of the readers of the "Journal" the subject of the pollution of water supplies. The Local Government Board are not experts in this matter, and cannot be expected to deal with the question intelligently unaided by water engineers. Therefore, as is suggested, it is imperative that a Royal Commission be appointed without delay, with full powers to examine expert water engineers who have made hydro-geology and water supply their lifework. There is an expert Committee already appointed by the British Association of Water-Works Engineers, who have very valuable information ready to offer. It is quite time that water engineers asserted their position, and demanded equal laws for all works of water supply throughout the United Kingdom—not a law for England, and another for Scotland; but let it be a Public Bill. The Local Government Board appear to be imitating the London County Council, by setting themselves the task of harassing every company seeking new powers before Parliament.

All readers of the "Journal" are fully aware that, when the small works of water supply are in the hands of the corporation or urban authority, there is great neglect of proper precautions; and progress is barred so as to meet the popular cry of keeping down the rates. I can point to works at present giving a very inadequate supply of water of third-class quality, because the rates are supposed to be already too great, and if they went for a new source the rates would be increased. These are watering-places, advertising and clamouring for an accession of visitors. Any Public Bill brought forward should include such cases, and compel them to provide a pure and wholesome constant supply.

The standard of a pure and wholesome potable water is now generally understood. The source from which the water is obtained, and all other information, are given to the analyst, who makes a chemical and bacteriological examination. These combined analyses, although they may be made daily, are not sufficient to protect the public from danger. Assuming the analyses and bacteriological examination to be capable of always discovering the baccili, it would be too late to prevent an epidemic, as the mischief would have been already done. The source of supply and the entire watershed should be purchased, and remain entirely under the control of the water authorities; and the land should not be allowed to be manured. Almost all the epidemics that happen are derived from shallow wells sunk near cesspools; and notwithstanding these facts—which are well authenticated and published—numerous cottages are still being built in precisely the same manner, even by water-works officials and rural sanitary authorities. If we travel through almost any village, we shall find the village pump within a few yards of the burying ground, or adjacent to the ashpit or cesspool in sewage polluted soil. The recent epidemic at Maidstone is always quoted, and many deductions made from the experience; but whether the farmstead or cottages were within the sphere of influence or otherwise, I maintain that on the whole of the gathering-grounds farmyards and cottages should be removed entirely. Koch states that subsoil water, which is abundant and found everywhere, is a fine filtered water, and may be thoroughly protected against infection. Surely this is a dangerous remark to put forward when a deep source of supply can be obtained. Whether it is safe or otherwise to use water derived from the subsoil, when all drains, sewers, and cesspools are properly built, it is far safer to remove the dangerous cesspools and defective sewers, &c., the leakage from which may be carried long distances—in the fissures of the chalk formation especially. We are already in possession of sufficient bye-laws, if the authorities did their duty, to compel every company to provide a pure and wholesome supply of water; but immediate practical legislation is required. All laws should be made compulsory; and corporations and rural sanitary authorities, &c., should stop every source of pollution by making bye-laws binding on the landowner, to abolish all defective cesspools, drains, sewers, and shallow wells.

The cone of depression caused by excessive pumping, and the protective area usually allowed in theory around the wells, are most uncertain and very unreliable data to depend on in the construction of either shallow or deep wells. Therefore the source of supply should be owned by the company, and properly protected from all and every probable source of pollution. This is now being recognized; and in many countries the watersheds are purchased, properly fenced in, not allowed to be manured, and the land cleared of all cottages, &c. The power to take samples of water is to be given into the hands of any sanitary official—no matter how incompetent or unscrupulous, or any ignorant, cantankerous consumer. It is well known whence this extraordinary piece of law-making emanated, and the *modus operandi* by which the authority essayed to take samples of water. I have known the inspector to scrape holes in the mud of a dirty reservoir left out for cleaning purposes, and carry away samples of water in phials stored in his trousers pocket. I have seen the sanitary official walk four miles with small bottles in his pocket, to take samples of water from the open reservoir. These bottles are filled with the surface water and called samples, whereas the water passes through perfect sand filters afterwards. The medical officer of health does not take the samples of water himself, nor see them taken, sealed, packed, and forwarded to the expert analyst. His aim is simply to find a dead end or disused main, or a filter-bed running out for cleansing, and collect samples from every available source and exhibit them to the committee, who find yet another opportunity to air the war cry: "Compulsory purchase or confiscation." They do not even come on the works with proper apparatus for taking samples of water; any bucket or pot serves the purpose to dip water to fill the bottles. I consider that the proper authority to take samples and report on the wholesomeness of the supply should be a qualified water engineer and expert analyst properly appointed by the London Local Government Board; and his duties should be defined similarly to the Water Examiner of the Metropolis. All reports should be recorded in the same form. Major-General Scott does not prowl about by night taking samples, as suggested in the new bye-laws; neither is he in collusion with interested unqualified local medical officers of health, or the "zealous water consumer."

This busy "water consumer," no matter whether he has paid his water-rate or not, or however unqualified, may give six hours' notice and *enter anywhere* to take duplicate samples from any stopcock, &c., &c. He should leave one sample with the Company; and he may analyze the second sample if *he likes*, and *retain the third for future comparison if required*—say, in twelve months' time. Can the ignorance of our law-makers be allowed to proceed further? We must have a practical and safe method of collecting the samples; and rules and regulations must be observed in all cases as to the forwarding of the samples to the analyst, and a standard be made compulsory for the examination of the water.

As to Rule 4 suggested by Mr. Griffith, it is altogether too arbitrary; and could not work well, nor be sanctioned by any properly conducted company—viz., to allow the referee to enter all or any consumers' premises for inspection. Neither should he have power to open all or any hydrants. It is well known that in many places the water is a little coloured at or near a dead end, where we always place a blow-out hydrant. It is quite sufficient for the water to be drawn from specified points on the distributing mains, where it is always being used and is in constant circulation. This is the system adopted by Sir William Crookes, Professor Dewar, and Sir Edward Frankland.

And, lastly, as to the suggested "Amendment of the Water-Works Clauses Acts"—"(4) Giving power to the referee to order the immediate closing or disconnection of any part or *the whole of any works*, or the alteration thereof for the purpose of protecting the water from pollution." Even a water-works engineer expert referee cannot be armed with such peremptory powers. Recent cases show that, where the referee would have closed the works immediately, Sir E. Frankland and other eminent experts declared there was no danger whatever, and the health of the community was never in a more satisfactory state—in fact, Mr. Griffith will know that, when before Parliament, it is a difficulty to get even water engineers to agree. Where would these referees be, when under examination before a Committee? The referee might report the advisability of closing certain wells or streams; but first of all he should close the cause of pollution, which probably would be outside the power of the company to do. But surely before closing the "whole of the works," and depriving the town of its water supply, the water engineer should be heard, and have ample opportunity and power given him to remedy any defect, and at the same time give the town a supply of water.

Superintendent.

Sept. 8, 1898.

Profit Sharing.

Sir,—I have been away from London, or would before this have asked you for space to say a word on "Profit Sharing." I had hoped that, after the last half-yearly meeting of the South Metropolitan Gas Company, when Mr. George Livesey dealt exhaustively with the subject, also with that of the workman director, that some enthusiasm would have been evoked in your columns. With the exception, however, of one or two very feeble letters from "Profit-Sharers" in the South Metropolitan Gas Company, I see no sign of any interest in the matter at all; the majority of them care nothing about profit sharing, especially when any of the "profit" has to go to those who produce all the profit.

We were told some time ago, by Colonel Makins, that Mr. George Livesey was the "Jeremiah" of the gas companies. Mr. Livesey admitted the soft impeachment; but, as an outsider, I prefer Mr. Livesey's description of himself—"I am the voice of one crying in the wilderness." From these two biblical quotations, I am fain to believe that both Colonel Makins and Mr. G. Livesey are "mighty in the Scriptures."

In the case of Mr. Livesey I am not surprised, because the first "profit-sharing" scheme is recorded in the book of Genesis; and it may be that he got a "tip" from the narrative, feeling, however, after the failure of this scheme that he would hedge his "own scheme" around with restrictions, useful to himself and the workman, so that it should not come to the same end—viz., a "strike."

Whether it is liked or not, profit sharing is with us, and has come to stay. Trades Union leaders may sneer at it; and some directors may quibble, and damn it with faint praise—as did one of the Directors of the South Metropolitan Gas Company. He was, however, only the "old lady with the broom." Since the year 1838, when the idea first suggested itself to the practical head of Edme. Jean Leclaire, the French decorator, the idea has taken some root. His workmen did not believe in it; but when at the end of the working year, he threw a bag containing £500 on the table, as their share of the profits in addition to their wages, they saw it at once. During the next twenty years he distributed £140,000, or about 14 per cent.; and after dealing thus generously with his work-people, Leclaire died a very wealthy man. The above statement has been dictated to me by a learned French gentleman, and can be relied on.

Success also attended the profit-sharing scheme at the Godins Iron-Works, at Guise, and was crowned with great success. M. Godin said: "Ever since the system was established, the workmen are interested in improving the output. They are quick in pointing out sources of loss; and they often make new and valuable suggestions." Mr. Lowe While, an English representative of the Board of Trade, reported: "Out of a squalid ignorant peasantry, M. Godin has produced an industrial community with the commercial alertness of the market place."

In this country the system of profit sharing is not of long standing. It was, I believe, first adopted by the Messrs. Briggs, at the Whitworth collieries in Yorkshire. It lasted ten years, and then it collapsed on account of a strike. During the ten years, the workmen received, in addition to their wages, £50,000. It will here be perceived that the strike put an end to the beneficent scheme.

It must here be noted that, in none of the cases referred to, was any provision made for investing the profit-sharing money in the company or firm where the men were employed. It was simply paid to the workman at stated times; so that there was no permanent interest as a shareholder in the company or firm. Herein lies the difference between these schemes and that of Mr. Livesey.

I need hardly point out that profit sharing will have a hard fight. Every Trades Union will be opposed to it, and every leader of every Union will do his best to vilify it with his followers; because the moment it is an accomplished fact his occupation is gone. The idea of the Union leader is to get up a strike; take all he can get; and then leave his dupes to get back as best they can—generally at a less rate of wages.

For a half-century I have carefully watched every strike in the country; and in almost all instances, the strike has been disastrous to the workman and to the profit of the leader. If anyone challenges this statement, I will try to give some remarkable instances.

I now, Sir, proceed to consider the profit-sharing scheme of the South Metropolitan Gas Company. In 1889 the great gas strike took place at the South Metropolitan Gas-Works. The strike cost the Company £100,000, and a little more. What it cost the strikers in money and misery, I do not know. I do know, however, that it cost Thorne and his friends nothing. So soon as the men had "had enough" and the strike was over, Mr. Livesey formulated his profit-sharing scheme; and from then till now the whole aspect has been changed—"mistrust giving place to friendliness and confidence."

In consequence of the scheme, the workmen have become shareholders and co-partners to the tune of £106,000; and all in about eight years. Soon the workman director will be on the Board, to look vigilantly after the interests of his fellow workmen.

At the Co-operative Congress at the Crystal Palace, presided over by Earl Grey (no mean authority), his Lordship said: "The profit-sharing scheme of the South Metropolitan Gas Company has solved the problem of co-partnership, which insists that labour shall have an equal share with capital in the surplus profits that remain, after the initial obligations to capital have been satisfied. The progress of civilized mankind being from status to contract, is to be from working for wages to co-partnership." His Lordship then focussed the idea that £1 of wages should receive £1 of dividend. I hope to see the time when labour will get a little more than this. Here, however, is the crux of the matter, and the solution of the problem. Let, at any rate, every gas company read—and digest.

I, as an uninterested outsider, say all honour to Mr. Livesey for his scheme and the courage with which he has carried it out in the teeth of opposition; and that it will be a success is certain. I would say to all employers—"Go thou and do likewise."

VINCENT TAYLOR.

Sept. 9, 1898.

LEGAL INTELLIGENCE.

THAMES POLICE COURT.—Monday, Sept. 5.

(*Before Mr.* MEAD.)

The Curtailment of the Water Supply at the East-End.

Mr. E. BEDFORD, of Arbour Square, Commercial Road, attended at the Court to-day with reference to an application he made to his Worship in the previous week in regard to the supply of water to certain baths. He was then told that if he could find any parliamentary authority for taking proceedings against the East London Water Company, a summons would be granted. He now stated that he had obtained the Company's Act, and found that section 62 contained a provision that "the Company shall not be liable to any penalty for not laying down any such main pipe or communication-pipe, if they be prevented from so doing by any unavoidable cause or accident, or for not supplying water if the want of such supply arise from frost, unusual drought, or other unavoidable cause or accident." For the moment he was not going to do anything in that matter; but his present application was with regard to a supply of water for domestic purposes. The words that met him were those in the section he had mentioned—"unusual drought;" and the question was whether he had any cause of action.

Mr. MEAD: Of course, the words you have to meet are "unusual drought."

Mr. BEDFORD: I am going to urge that it has not been an unusual drought. For the last few years there has been a species of famine; and in 1897 the Water Company applied for a fresh Act of Parliament, when they said that after it had been granted they would construct new reservoirs, and that sort of thing would never occur again.

Mr. MEAD: This is only 1898. Have the reservoirs been built?

Mr. BEDFORD said they had; but the reservoirs were absolutely useless, for they had been depleted to such an extent that the supply had been further reduced from six to four hours a day.

Mr. MEAD: You cannot get blood out of a stone. If the water is not there, you cannot get it.

Mr. BEDFORD: But there has been no famine with regard to any other Company.

Mr. MEAD: It is common knowledge there has been a famine in other parts of the country; and I myself know one place on the south coast that has been on short commons. I should say this has been a most unusual drought, for it was prophesied in the winter. The cause is not due to the dry weather, but is owing to the deficiency in the rainfall some months back.

Mr. BEDFORD, resuming, said that after the steed had been stolen the Company were waking up. Here they had a Company with an output greater than their inlet. They obtained an Act giving them certain powers, but had neglected to fulfil their statutory obligations until famine occurred. They had now started on the work; but it would be six weeks before it could be completed. Were the people in the East-end to go on suffering in this way while the Company sheltered themselves behind their Act? The question was a serious one; but unless something could be done he did not wish to "tilt at windmills." He therefore asked whether his Worship could assist him in the matter. An extraordinary fact in connection with it was that in ordinary times the sanitary inspectors were always coming to the Court on account of drains not being flushed; but now they never came near.

Mr. MEAD said whether anything could be done or not the people who were suffering had his utmost sympathy, for it was not only the consideration of convenience but of health which was involved. As it might be said he had no right to bring into Court knowledge that he had obtained elsewhere, Mr. Bedford might take a summons to see whether there had been an "unusual drought;" but it would only be heard on the ordinary terms. He (Mr. Mead) could not help feeling the evil had been aggravated by the waste that had been going on.

Mr. BEDFORD thanked his Worship, and said he would consider the matter.

MISCELLANEOUS NEWS.

THE STRIKE AT THE LLANELLY GAS-WORKS.

Settlement Concluded by Mutual Concessions.

With the manning of the gas-works by non-unionists at the beginning of last week, the trouble at Llanelly did not by any means cease. In their difficulty the Company sought the assistance of Mr. Graeme Hunter, of the Labour Exchange, Glasgow and Manchester; and he supplied the men required. The measures taken for getting them into the works without disturbance appear to have been very carefully planned; but nevertheless their entrance into the town provoked a good deal of hostile demonstration. Some of the "free" men reached Llanelly station during Monday evening, where they were met by Mr. Arthur D. Davies, the Chairman of the Company, Mr. A. R. Cawley, the Manager, and a police escort. They were immediately driven to the works in an omnibus, one of the windows of which during the journey was broken by a brick; Mr. Cawley only just luckily escaping the missile. Not expecting that any more would come that night, the Union men and the crowd which had assembled afterwards dispersed; but they were mistaken, for at 2 a.m. seventeen other men who had travelled as far as Landore by the midnight express reached their destination, by means of a brake, without incident. Complete arrangements had been made for lodging and provisioning the men on the works. The local Secretary of the Gas Workers' Union was very active in trying to intercept the non-unionists for the purpose of persuading them not to enter the gas-works. But he was unsuccessful; and by Tuesday evening there was again sufficient gas to partially light the streets, and a fairly good supply for private use. During the night there were two or three instances of consumers having their windows broken through burning what was termed "blackleg" gas. Evidently Mr. Morgan was not altogether satisfied with the course the contest was taking; for he telegraphed to Mr. W. Thorne, the General Secretary of the Union, requesting his assistance. Mr. Thorne complied; and there is no doubt that his presence and influence did much towards bringing about a settlement of the differences between the Company and their old hands. On Wednesday, there were indications that the strikers were desirous of concluding the dispute. The Union officials had an interview with Mr. Cawley; and the strikers had a private conference with their leaders. In the evening, a public meeting was held, which Mr. Thorne addressed. In the course of his remarks, he stated that the men whom it was sought to have taken on again in the order of seniority were thoroughly competent. It had been clearly set forth in the case of *Allen v. Flood* in the House of Lords that workmen had a perfect right to say with whom they would work; and the men's claim to promotion by seniority ought to be recognized. At the private meeting of the stokers resolutions had been passed to the effect that there should be an eight-hour day, and payment for the same at 4s. 3d., as at present. At an early hour on Thursday, the Union officials and three of the leading men on strike had an interview with the Directors and Manager of the Company; but nothing was then determined. In the afternoon, there was a second conference, which continued between two and three hours, and ended in a settlement being arrived at by a little yielding of points on both sides. The old hands resumed work the same night, greatly to the satisfaction of the gas consumers and the inhabitants generally. The whole trouble has now terminated, except for the actions that are threatened against the Company for alleged breach of contract.

AUSTRALIAN GASLIGHT COMPANY.

The Annual General Meeting of this Company was held at the Head Office of the Company, in Sydney, on the 25th of July—Mr. G. J. COHEN, the Chairman, presiding.

The SECRETARY (Mr. R. J. Lukey) having read the advertisement convening the meeting, the report of the Directors was taken as read. In it the Directors expressed much pleasure in stating that the profits for the six months ending June 30, after making provision for bad and doubtful debts, deducting interest on borrowed money, repairs and renewals, depreciation of plant, working expenses, and all other charges, amounted, with the balance brought forward, to £54,559 14s. 8d. They recommended the payment of a dividend for the six months of 9s. per share, free of income-tax, which would absorb £51,134 17s.; leaving a balance of £3427 17s. 8d. to be carried to the next account. The Directors stated that the consumption of gas was steadily increasing, notwithstanding the almost general use of incandescent burners for private and public lighting. To improve the supply of gas, more particularly in the city, it had been found necessary to lay an additional 24-inch main; and the work would shortly be completed. More than 1000 new consumers had been obtained at Balmain, through the fitting up of small dwellings and supplying them with penny-in-the-slot gas-meters. The system was being extended to other suburbs with satisfactory results. After much negotiation between the Board and the Company's workmen, an Employees' Mutual Benefit Society was established in February last. A sound financial basis having been adopted, the Society is likely to prove of permanent advantage.

The CHAIRMAN, in moving the adoption of the report, expressed the pleasure he felt at meeting the shareholders with so favourable a balance-sheet. The expenditure was somewhat in excess of that of the corresponding period last year, due to the extra cost of labour in connection with the fitting up of small dwellings for prepayment meters, the maintenance of the incandescent burners for the public lights, and the payment of two years' land-tax. On the other hand, the consumption of gas had increased, and better prices were obtained for residuals; consequently, the extra income from these sources had more than met the increased expenditure. Gas cookers, stoves, and other gas appliances, were being more generally used; resulting in a large increase of gas consumed during the daytime, which now equalled 36·6 per cent. of the total sales. To meet this extra demand, it became necessary to lay the additional 24-inch main mentioned in the report. Touching upon general subjects, the Chairman said the Company's "Historical Sketch," promised at the last meeting, was issued to the shareholders in March, and had been kindly

received and favourably commented upon. With reference to the penny-in-the-slot meters, the success anticipated had been more than realized. Applications were coming in at a rapid rate; and before long this new class of customer would become very great indeed. It was with much satisfaction that he mentioned the establishment of an Employees' Mutual Benefit Society. The whole of the workmen were members of it; and the interest they took in its management augured well for the future prosperity of the Society. The Company's contribution was 25 per cent. of the amount subscribed by the members, but not, however, to exceed £200 per annum. The usual care had been bestowed upon the plant and works; and the Engineer (Mr. T. J. Bush) reported them to be in thorough order and condition. An ambulance class in connection with the St. John Ambulance Association had been established at the head station; and in February last he was afforded the pleasure of presenting "First Aid" certificates to 39 of its members. Everything necessary to meet ordinary accidents was now provided on the works, which he thought was highly essential in gas-works of the magnitude of those belonging to the Company. During the past year, 92 additional public lights had been erected, and 51 miles of mains and service-pipes laid. The gas-cookers, including those sold other than the Company's, numbered 8182. There were 320 gas-engines and 35,936 gas consumers.

Mr. W. G. Robinson seconded the motion; and it was unanimously adopted.

The retiring Directors and Auditors were re-elected; and a unanimous vote of thanks was accorded to the Directors and officers for their successful management of the Company's affairs.

THE INCREASE IN THE PRICE OF GAS AT NEWCASTLE.

The City Council Disapproves of the Company's Action.

The Newcastle City Council had before them last Wednesday a report by the Gas and Water Committee on the subject of the recent increase in the price charged for gas by the Gas Company.

Mr. Riley Lord, in moving the adoption of the report, said the Committee had inquired of the Company the cause for the increase of 2d. per 1000 cubic feet; and they gave it that there was a decrease in the amount received for residuals, and also that there had been a very considerably larger sum paid for coals. In addition to this, the Company were laying out at Walker half a million of money in new works, a great deal of which for years would be entirely unremunerative. The price for gas would now be the same as it was in 1890 (it was reduced 2d. in 1891), when the reserve in hand was £60,000. The reserve was now £8000. The reduction in the price of gas in 1891 had placed in the pockets of the consumers of gas about £90,000; while it had only put into the pockets of the shareholders some £18,000. He believed that the increased cost of coal and the reduced income from residuals more than covered the increase which would be obtained by the increase of 2d. However, the real protection of the consumers was this: That the shareholders themselves would see that the price was reduced as soon as possible, in order that they might get increased dividends. Their interests were bound up in the interests of the consumers.

Alderman Stout could not understand why, when the consumption of gas was increasing by leaps and bounds, the consumers had to pay for the extension of the gas-works and to augment the Company's reserve fund.

Mr. T. Cairns did not think it was fair that the public of Newcastle should have to contribute to the capital expenditure of the Company, with the prospect of getting no return, or practically no return. He moved that the Town Clerk be asked to inquire into the legality of increasing the price of gas for the purpose of capital expenditure.

The Town Clerk said he had already inquired into the whole matter; and he was quite satisfied that the Corporation had no power whatever to interfere beyond their statutory authority.

Alderman Newton said they certainly ought to record their opinion of the action of the Gas Company in the matter; and he moved—"That the report is unsatisfactory, and is hereby rejected, inasmuch as this Council disapproves of the action of the Gas Company in taxing the inhabitants for the purpose of erecting the new works at Walker and St. Anthony's."

Alderman Temple seconded the amendment.

Alderman Stephenson said the increase in the price of coal for the year ending June 30 next, the contracts for which had already been made, would cost the Company considerably more than they would get from the 2d. increase in the price of gas.

After further discussion, Alderman Newton agreed to modify his amendment so as to make it read: "That this Council disapproves of the action of the Gas Company," &c.

The amendment in its altered form was carried.

HARROW AND STANMORE GAS COMPANY.

The Half-Yearly Meeting of this Company was held yesterday week, at the Albion Tavern, Aldersgate Street, E.C.—Mr. James Glaisher, F.R.S., presiding.

The Secretary (Mr. J. L. Chapman) having read the notice calling the meeting, it was agreed to take as read the report and accounts, of which an epitome appeared in our issue for the 30th ult.

The Chairman said he had no doubt the shareholders had looked with interest at the accounts for the past six months; and, if they had examined them carefully, he was certain that, at the end of their investigation, they had felt satisfaction, for it was a good record of work done. He should like first to say a few words as to the working. The quantity of coal carbonized was 3111 tons; being 358 tons more than in the corresponding period of 1897. Considering the warmth of January and February last, and the effect that it had on most gas companies, it was remarkable that he should have to speak of an increase of almost one-tenth in the amount of coal carbonized. The quantity of gas made was 31,789,000 cubic feet; being an increase of 3,350,000 feet. The quantity sold was 27,870,000 cubic feet, which was an advance of 1,644,000 cubic feet, or nearly 6 per cent. The unaccounted-for gas was no less than 3,569,000 cubic feet, which was almost equal to 11¼ per cent. of the make, and nearly twice as much as they had hitherto had to report. He need scarcely say that this loss of gas had caused great anxiety both to the Engineer and himself. Mr. Chapman had sought everywhere to find the cause; and in a letter which he had addressed to him (the Chairman) on the subject, he spoke about the new gasholder being started, and mentioned that for a time the holder at Stanmore was worked without a meter. He further stated that considerable lengths of electric light mains had been laid near the gas-mains, resulting in a number of old services being disturbed; that many new drainage pipes had been put down; and that heavy steam-rollers were being used by the smaller rural councils. These things, and the comparatively dry season, had all tended, their Engineer said, to increase the leakage account; and he had found a few considerable leakages. He (the Chairman) must confess that the causes referred to did not, in his opinion, account for the loss of so much gas as they had experienced—an increase of nearly 2 millions. From the communications he had had with Mr. Chapman, and after reading over the accounts, and seeing the profit they had made, he could not but think that there was a mistake somewhere, and that such a large amount of leakage could not have taken place. He had suggested to Mr. Chapman that the station meters were rather fast; but he did not agree with him. However, their Engineer assured him that no effort would be wanting on his part to find the cause of the leakage, and to bring it back to its normal condition. This he (the Chairman) felt certain he would do. The quantity of gas sold in Harrow was 15,394,000 cubic feet; being an increase of 491,000 feet. At Sudbury and Harrow Weald, they had sold 3,418,000 cubic feet; being an increase of 569,000 feet. At Stanmore the consumption had been 6,038,000 cubic feet, or an increase of 547,000 feet. These figures were exceedingly gratifying. The Sudbury increase was really remarkable, and was not merely an evanescent one. As to the residual products, they made 1866 tons of coke, of which 1548 tons were sold. About 480 tons were also used on the works. Of tar they produced 31,551 gallons, which was at the rate of 10 gallons per ton of coal carbonized. Of sulphate of ammonia 30 tons were made, which was nearly equal to a ton per 100 tons of coal used. Turning to the monetary results, they had received £6417 for gas and meter and stove rentals; and for residual products, £1110. The total revenue was £7529, which was an increase of £538. As to the expenditure, coal only cost £212 more than in the first half of last year, which was very gratifying, considering the additional quantity carbonized. The total expenditure for the half year was £5017, which exceeded that of the corresponding period by £351. The profit amounted to £2512, which was an improvement of £187. He ought also to mention that £100 had been written off suspense account. Referring again to the growth in consumption of gas, he said that, from the investigations he had made, the increases had been well maintained, half year by half year, ever since Stanmore was amalgamated with the Harrow undertaking. With the one exception of leakage, the accounts were satisfactory, and promising for the future. He had much pleasure in moving their adoption.

Mr. Charles Horsley, J.P., having seconded the motion, it was unanimously carried.

Dividends were next declared at the rates of 7½ per cent. per annum on the original "A" capital, 7 per cent. on the "B" capital, 5¼ per cent. on the "C" capital, and 6 per cent. on the guaranteed shares.

The hearty thanks of the shareholders having been accorded to the Secretary and Engineer, a similar compliment was passed to the Chairman and Directors, on the proposition of Mr. A. F. Phillips, seconded by Mr. T. H. Martin.

NOTTINGHAM CORPORATION GAS SUPPLY.

Annual Reports and Accounts.

We have received from the Engineer and General Manager of the Nottingham Corporation Gas-Works (Mr. W. R. Chester), the reports and accounts referring to his department for the year ending March 31 last. Viewed generally, they show that, owing to the exceptionally mild weather during the winter months, the increase in the consumption of gas was small; but, on the other hand, there was a substantial addition to the number of new services laid and meters fixed, which, with changed climatic conditions, cannot fail to produce a considerably greater increase in the consumption. The Gas Committee's report shows that the quantity of gas sold during the year was 1,588,041,000 cubic feet, against 1,572,699,400 feet in the previous year; being an increase of 15,341,600 feet. The amount realized from the sale of gas was £190,891, against £189,758; being an increase of £1133. The return for coke and sulphate of ammonia, as compared with last year, exhibited an increase of £2715; but the amount received for tar, &c., was less by £1702. The net profit for the year is £27,152. Of this, £24,000 will be paid over to the Finance Committee, by order of the Council, in aid of the current expenditure of the municipal year; and £3000 transferred to the reserve fund, in repayment of loan—leaving a balance of £152 to be carried to the annuity redemption fund.

Mr. Chester's report deals with the works and distribution system. He says that the plant, machinery, and buildings at the various stations have been kept in good repair, and that their efficiency has been fully maintained. The mechanical appliances for carbonizing and handling coke at the Basford works have been in continuous operation since November last, and continue to work well. More than 100,000 tons of coal have now been dealt with by this machinery. Considerable attention has been paid to the distributing portion of the apparatus. The trunk mains coupling up the various works have now been completed; and for the future it will be possible to supply the whole of the districts from any two of the three works, should an accidental cause arise for so doing. The average illuminating power of the gas for the year was 18·84 candles; and the sulphur compounds were kept down to 21·80 grains per 100 cubic feet. Regarding the distribution department, Mr. Chester reports that the total mileage of mains is 296·11; 5·66 miles having been added during the year. The number of meters fixed on March 31 (including 355 lamp meters) was 43,124; being an increase of 1522. Of these 40,637 belong to the department, and 2487 to consumers. The demand for prepayment meters continues to increase. At the end

of the financial year 5369 were in operation—being an increase of 1096. New services to the number of 2348 were laid, against 1602 in the previous year. The application of gas for trade and domestic purposes, other than for lighting, also continues to increase. There are 4850 gas cooking-stoves at present in use, 5040 gas-fires, and 377 engines, besides a very large number of other appliances of almost every description, which have not been numbered. Of the 4850 cookers in use, 4503 are rented from the department.

The accounts accompanying the reports show that the total amount received on capital account to March 31 was £1,026,333; and the total expenditure was £1,025,268, of which £11,647 was spent during the year. From the total expenditure is deducted £500 transferred from the net revenue account for depreciation of gas-stoves; and consequently the balance in hand is only £1565. From the revenue account, it is seen that the private consumption of gas produced £181,525; public lights, £9366; rental of meters, £6224; rental of stoves, £1982; coke and breeze, £19,794; tar and its products, £14,156; sulphate of ammonia, £8993; refuse lime and oxide, £1057; and sundries, £4300—making the total revenue £247,398. Under the head of manufacture of gas, on the expenditure side of the account, coal is entered at £75,227; purifying, at £4103; works salaries, £1867; carbonizing wages, £23,767; and repair and maintenance of plant, &c., £28,261. Under "distribution," a total of £20,657 was spent; and for rents, rates, and taxes, £11,269. The management expenses amounted to £6677; and some smaller items (of which bad debts, £324, was the largest) made the total expenditure £172,231. Thus there was a balance of £75,166 to be carried to the net revenue account. Of this balance £43,374 is required for interest and annuities; £500 for depreciation of gas-stoves; £618 for sinking fund (loans and debentures); and £3522 for the consolidated stock sinking fund account. After satisfying these demands, the net profit, as already mentioned, is £27,152.

The above reports and accounts were submitted at the meeting of the City Council yesterday week, and were adopted without discussion.

BELFAST CORPORATION GAS UNDERTAKING.

The Payment for New Works out of Revenue.

The minutes of the Gas Committee having been moved and seconded at the last monthly meeting of the Belfast Corporation, Alderman Dempsey questioned the policy of the Committee in having appropriated a considerable portion of the past year's profits for the payment of new works. He said that, according to the Committee's report, the balance brought forward from the previous year was £2054; and there was now left available £32,333. It seemed to him that so profitable a sale of gas would entitle the Committee to consider the question of further reducing the price, especially as the electric light was coming into competition, and as the use of oil was so dangerous. Instead, however, of their proposing to reduce the price of gas, they had agreed to distribute the amount as follows: "For the depreciation of meters, 10 per cent., £2661; for the depreciation of lamps, 10 per cent., £630—£3291." Then the Committee stated, without a word of explanation, and with the skill of financiers of a very high order, that the expenditure on new works and mains, £19,393, and on new meters, £7728, should be simply written off out of the year's profits. He thought the Corporation were entitled to some explanation of this proposal to wipe out a capital sum of nearly £30,000. He hoped such excessive expenditure as had caused the necessity for this extraordinary step would not be continued by any of the departments having control of the borough fund. Mr. Stewart mentioned that, when this matter came before the Committee, he objected to the resolution for the payment of new works out of revenue. None of them would take such a course in his own private business; and he must join Alderman Dempsey in protesting against it. Mr. Wheeler proposed that the matter be referred back for further consideration. The Town Clerk intimated that the borrowing powers under the Act of 1874 were virtually exhausted; and the Committee had no other means than the revenue of paying for these works. Mr. Wheeler hoped someone would second his resolution. The Committee, he urged, could properly consider the question of obtaining power to borrow more money on the gas undertaking. The Town Clerk: That would involve an Act of Parliament. Mr. Wheeler: Very well, let us obtain one. The Town Clerk: It would serve for the future, but not for the past. Mr. Jaffé explained that this mode of dealing with the surplus profit was commenced virtually only last year, because it became clear to the Committee that their borrowing powers were exhausted, and they had to make certain extensions which could not be carried out by any other means. Mr. Wheeler did not press his amendment; and the proceedings were confirmed.

BOLTON CORPORATION GAS AND ELECTRIC UNDERTAKINGS.

Large Profits.

Mr. George Swainson, the Bolton Borough Treasurer, has just issued his "Blue-Book" dealing with the finances of the several undertakings of the Corporation for 1897-8.

He records that the total income for gas and lighting was £135,053; this being rather less than was the case in the preceding twelve months—due to the lessened amount received from the sale of residual products (£23,588, as against £25,464). The revenue from all sources, however, was only £200 less; and the Committee were enabled to transfer £26,466 in aid of the rates. This was the largest sum ever transferred to rating account out of the profits of the department; being equal to £4 3s. 7d. per cent. on the capital outlay. The Committee were able to do this because the average cost per ton of coal and cannel carbonized was only 9s. 6d., compared with 10s. 2½d. the year before—the figure quoted being the lowest for the past nine years. The Committee also reduced the capital account by £5000; and £4000 was spent on Arrol Foulis mechanical stokers. In the electricity department, the capital account has grown from £24,459 in 1895 to £57,037 in 1898. The current supplied to customers last year brought £5720, as against £3736 the previous year. The profit of £917 was carried to the reserve fund.

THE DANGERS OF PARAFFIN LAMPS.

A Coroner's Testimony to the Value of the Prepayment System of Gas Supply.

A few days ago, an inquiry was held at West Bromwich relative to the death of Hannah Turner, a widow, who kept a small shop where she sold lamp oil. She lived alone; and it appears from the evidence adduced that she met with her death through a fire caused by the breaking of a paraffin lamp. The Captain of the Fire Brigade (Mr. W. H. Wayte) testified to finding the body of the deceased lying upon the floor of her house, with the lower part of it badly burnt, some of the clothing burnt off, and the rest smouldering. A broken lamp lay beside the body; the oil having all burnt away. From the way in which the table was burnt, his opinion was that the deceased, who had taken off her boots, had sat down beside the table, fallen asleep, and in her sleep accidentally upset the lamp, which had burnt through the table, and set her clothing and the chair on fire. The Coroner (Mr. J. Clark) thought the inspection of the body bore out the theory of Captain Wayte. The case was just another instance of the old, old story with these lamps. If there was one thing in this world which he abominated more than another, it was glass lamps with common oil. So long as they were used, so long would they have these terrible fatalities to inquire into. He was glad to say, so far as the governing authorities of the town were concerned, the reproach could not be put upon them that they gave no opportunity to the people of having any other illuminant than these glass lamps. The people could now have gas laid on under an arrangement by which the Corporation put in the fittings free of cost; and the payment for the gas was small, and made in a convenient way. There was no longer any excuse, on the ground of expense, for the use of these dangerous lamps. The Jury returned a verdict of "Accidentally burnt to death."

ELECTRIC LIGHTING NOTES.

The Local Government Board have given their sanction to the borrowing of £33,000 by the Salford Corporation for electric lighting purposes. Of the sum named, £23,000 is for the establishment of three battery sub-stations, and £10,000 for the land for new generating stations.

The Walker and Wallsend Union Gas Company are proposing to apply for a Provisional Order to empower them to supply electricity in their district. They have asked for the consent of the District Council to their application; but that body have declined to give it, on the ground that they intend to seek for similar powers.

A memorial is being framed for presentation to the Wallingford Town Council, praying for the introduction of a system of electric lighting in consequence of the high price of gas. The Gas Company charge 4s. 9d. per 1000 cubic feet, and have refused to entertain the proposal to sell their undertaking to the Corporation for the sum of £7500.

The Electric Lighting Committee of the Tunbridge Wells Town Council certainly merit the heartiest thanks of the ratepayers. They have agreed to contribute towards the general district rate a sum of £900 from the profits of their undertaking, instead of £450 originally decided upon. This doubling of the contribution, we are told, will obviate the necessity of putting an extra penny on the rates.

It was reported to the Stockton Corporation last Tuesday that the Local Government Board had sanctioned the borrowing of £28,482 for a period of 25 years for the carrying out of the electric light scheme, and had also approved the use of certain ground in close proximity to the gas-works for the station. Alderman R. Hind, the Chairman of the Gas Committee, intimated that the contract for the works would be completed in a few days; and the Committee hoped within twelve months to be able to supply the town with electricity.

Telegrams from Geneva last Thursday state that the great electric power station of the City of Geneva, situated at Chevres, was almost entirely destroyed by fire during the night. The works, which were only erected in 1896, were considered the best in Switzerland, and cost about 5,000,000 frs. During the night one of the wires fused, and set fire to the roof, which was soon in flames, for a distance of 150 yards, and, falling into the interior, set fire to the contents, which were burnt. Numbers of manufactories will be thrown idle through the lack of motive power.

The Electric Lighting Committee of the Bristol Corporation have arranged to reduce the price of their supply from 6d. to 5d. per unit on and after the 1st prox. This will represent between £3000 and £4000 a year; and the Committee hope that the increased demands will more than cover that within a short period. The reduction is practically equal to the profit which the Committee estimate to make in the current year. It is stated that, if it had not been that part of the cost of the new works has fallen upon the Committee this year, the profit would have been larger. These new works are as yet unproductive, because, though the structure is finished, the machinery is not fixed. It is hoped, however, that it will be in working order by October, and then the capacity of the establishment will be equal to 80,000 incandescent lamps—the present number served being 54,700 out of a possible 60,000.

At last Wednesday's meeting of the St. Pancras Vestry, the Electric Lighting Committee formally reported the explosion in Cumberland Terrace on the 12th ult. (*ante*, p. 390), and stated that Major Cardew, on behalf of the Board of Trade, and representatives of the London County Council, had visited and inspected the area disturbed. On the report made to them by Major Cardew, Mr. F. J. S. Hopwood, of the Board of Trade, had forwarded a communication to the Clerk in which he said: "Having regard to the grave risks to the public safety and the disorganization of the supply of energy involved by accidents of this nature, I am to urge upon the Vestry the necessity of taking all possible precautions to prevent accumulation of gas in their culverts; and as it would appear to be impossible in all cases to provide adequate ventilation, I am to suggest the desirability of frequent inspection of street-boxes." The Vestry wisely received this communication in silence, and agreed with the action of the Committee in formally notifying The Gaslight and Coke Company that, in consequence of the damage done to the Vestry's property, a claim in respect of the cost for making good will be made. It is understood that about 400 yards of the Vestry's culverts and mains were affected.

THE DRY WEATHER AND THE WATER SUPPLY.

The Curtailment of the Supply at the East-End.

Our record of the principal events arising out of the enforced curtailment of the water supply at the East-end opens this week with a notice of a meeting held at the Hackney Town Hall on Monday, the 5th inst., called by a requisition signed by fifty ratepayers. Mr. T. Hosgood, the Chairman of the Vestry, presided; and there was a large attendance. Dealing with the object of the gathering, the Chairman said the water famine was one of the greatest scandals of the nineteenth century. The Water Company said there had been waste, and that waste took place then. They further said they pumped 26½ gallons per head into the district. All he could say was that if this quantity of water were pumped into the district, it did not reach the inhabitants. As Chairman of the Vestry, he did not wish to strongly condemn the Company, as the Vestry had taken action in a Court of Law to ascertain what really were the rights of the ratepayers and the Company. He hoped there would be no deaths in East London as a result of the water famine; but if there were, then it was probable that some of the Directors might be charged with manslaughter. Mr. H. R. Taylor moved a resolution calling upon the Government to place the water supply in the hands of a representative body like the London County Council. Mr. Cohen seconded the resolution, which was supported by Professor Stuart, M.P., who stated that the East London Water Company had been for eighteen months in possession of the power to make connections with the mains of other Companies; and he asked why the making of them was delayed until now. Mr. W. Steadman, M.P., read a letter from Mr. Chaplin, the President of the Local Government Board, dated the 31st ult., in the course of which he said: "There can be no doubt of the hardship, especially in the hot weather, which is inflicted upon many of the poorer classes by the curtailment of their water supply. Many, and indeed most, of them have no adequate means of storage in their houses; and you may rest assured that, so far as this Department is concerned, everything that can be done is being done and shall be done to mitigate the evils of the situation. I have not the smallest doubt that, in view of the prolongation of the drought and the depletion of the reservoirs, the restriction of the supply as a precautionary measure was a necessity; but I am in communication with the Company as to the various measures which may be possible for increasing the supply. Some of them have been adopted already; others are in progress; and I have every reason to believe that the Company are willing and anxious to do everything that is possible to relieve the situation. There is one thing which I view with considerable apprehension—viz., the amount of waste which is undoubtedly occurring—in some cases, it is alleged, intentional waste, though how far that is true I do not know. But it is greatly to be regretted; for at present the Company have not got the water to justify them in continuing the old rate of supply, and every gallon that is wasted now will only hasten the time, if the drought continues, which will render a further curtailment inevitable." The resolution was carried *nem. con.* An overflow meeting of upwards of 1000 people was held outside the hall.

By Monday morning the officials of the Company were able to ascertain the result which had accrued from the further restricted service of water of four hours daily to their customers, which came into force on the previous Saturday. It was reported that the effect was far from what had been anticipated, and was most disappointing. With the water turned on for a period of a third less than before, it was expected that, as a matter of course, there would be a proportionate saving; but that hope had not been realized. The quantity pumped into the district on Saturday showed that during the four hours only a million less gallons were used by the consumers than was the case during the six hours' service, although a saving of 10 million gallons was expected. The consequence was that the reserve stock, which it was hoped to keep for an emergency by means of the curtailed supply, had after all to be drawn upon. It was reported by Mr. Bryan, at the Directors' meeting on Thursday, that during the previous week 33 million gallons of water per day were pumped into the district; this being equal to 25½ gallons per head.

The project for increasing the supply indirectly by connecting the mains of the Grand Junction and New River Companies took definite shape on Tuesday. The Engineers of the three Companies met in conference, and settled all the arrangements for commencing the work at once. The scheme is this: The New River Company's district is situated between the two others, having the East London on its eastern and the Grand Junction on its western side. Since the commencement of the scarcity, they have been giving the East London all the water they can spare, by way of the River Lea, which is common to both. They could give no more from their own resources, nor could the East London obtain any directly from the Grand Junction, though the latter have now a certain surplus. The plan is, therefore, to connect the Grand Junction with the New River, and pass so much water into the mains of the latter, who will then be able to allow this additional quantity to flow down to East London. To make the connection, it will be necessary to lay 1¼ miles of 24-inch piping; and the work will probably take a couple of months, if not longer. "The Times" Special Correspondent regards this scheme as being "chiefly interesting as another step in the direction of that amalgamation of the Water Companies which has been made inevitable by recent events." Owing to the time which it will take to complete, the scheme offers no prospect of relief in the present emergency.

On the other hand, the work of connecting the Southwark and Vauxhall Company with the East London by the Thames subway is making rapid and satisfactory progress. No exact date can yet be stated for its completion; but there is a fair prospect that the other resources of the Company will hold out until then, and render further curtailment unnecessary, despite unfounded statements to the contrary. Several of the Local Authorities are doing their best to assist in tiding over the interval; and the bulk of the consumers are showing a rational appreciation of the situation. Complaints are much fewer than they have been, in spite of many "indignation meetings." The investigations of the Special Correspondents of "The Times" and other papers clearly prove that the statements made at these gatherings are no indication whatever of the real feeling of the people or of the actual condition of things.

On Friday, a deputation consisting of members of the London School Board, waited upon Sir Hugh Owen, Permanent Secretary to the Local Government Board, with respect to the supply of the schools within the East London Company's area of supply. It was pointed out by the speakers that about 100 of the Board's schools were supplied by the Company, and that the children attending those schools numbered about 110,000. In 23 of the schools, representing an attendance of 25,000, the water supply was very unsatisfactory. The Company had promised to provide a constant supply during school hours; and the speakers strongly urged that this promise should be carried out. They asked that the voluntary schools, which were not as favourably situated as the Board schools (in whose case the meter system was in vogue), should be placed on an equal footing with the Board schools, and that any improvement in the supply which might be procured for the Board schools should be also extended to voluntary schools. Complaint was also made that, although there was a guarantee given by the Company in 1895 to maintain a constant supply, there was no guarantee as to pressure, and cases were cited in which the pressure did not extend above the ground floor. Mr. John Lobb asserted that the Company's increase of supply during the past twenty years had not been commensurate with the increased demand, and also complained that during that time the pipes had not been properly repaired and renewed. Economy was at the root of the present trouble. Sir Hugh Owen, having expressed his sympathy with the objects of the deputation, said the arrangement made by the Company appeared to be a liberal one when it was considered how great their difficulties were with other consumers. The pressing question was how to meet the present difficulty; and he believed the Company were doing all in their power. Of course, they had not anticipated the present state of affairs; and as recently as three months ago, the Local Government Board received a communication from the Company stating that they did not anticipate any difficulties. The Company would probably have to be dealt with after the present difficulties had ceased. It is understood that Sir Hugh Owen will write a letter to the Company in which he will embody the views of the deputation—practically making them the views of the Local Government Board, and calling upon the Company to fulfil their promise, made in 1895, of a constant supply to the schools.

During the week some of the Local Authorities addressed indignant letters to the Local Government Board in reply to the circular sent out by the President. The Hackney Vestry observed, "with surprise and pain," that the Board had no doubt that, notwithstanding the deficiency of the water supply, there was a large waste of water in the district; the waste being in some cases wilful and in others the result of carelessness. They strongly condemned such a charge being made by the Company, without a shred of evidence in its favour. Indeed, the letter said, the evidence relating thereto was strongly against it, as when a deputation from the Vestry waited upon the Company on Aug. 23, the Engineer (Mr. Bryan) admitted that he had no special complaint to make regarding this. As a matter of fact, there were a large number of roads in the poorer districts where there was actually no supply from the Company's pipes; the only present source being the water-carts provided by the Vestry. The letter expressed the astonishment of the Vestry that the Board should have made such an accusation against the people in the East of London. The Shoreditch Vestry, in a reply, emphatically declined to insult the intelligence of the water consumers of their district by urging them, as suggested, not to waste water which they did not get for twenty hours out of the twenty-four, or to assist the Board in thus trying to shift some of the blame of this famine on to the wretched victims of it. The letter proceeded: "The only waste of water known to this Vestry is that caused by the leaky and defective pipes and mains of the Company . . . and to assume because the Company alleged they pump so many gallons of water per consumer into their mains, that such amount ever reaches such consumer to be wasted by him, is to confess a faith in the condition of the Company's mains that would be rudely shaken if your Board would cause a test to be made of them by raising the pressure therein to 100 lbs. per square inch, as provided by the New River Company." The Vestry also desired to take this opportunity of informing the Board that public opinion in the district was beginning, after contemplation of the history of this water question, "to have very considerable doubts as to the disinterestedness or intelligence of the Government in their dealings with this matter."

Replying to a request from Mr. H. Robertson, M.P., for full particulars regarding the drought, Mr. Bryan has addressed a long letter to the Member for South Hackney, in the course of which he says that the drought has now lasted thirteen months. The total rainfall from July 30, 1897, to Sept. 5, 1898, was under 15 inches; and the rainfall from Jan. 1 to Sept. 5, 1898, was 8·62 inches. The rivers and springs are always dependent upon the winter rainfall; and consequently although the Company's reservoirs were full on June 20, the flow of the river has been so minute since then that depletion of the reservoirs was abnormally rapid. The present drought has beaten all records; and he cannot see how it is possible for any reasonable man to blame the Company for what no living person could have foretold. All he knows is that the water available for his Company after the New River Company have taken their 22½ million gallons a day does not amount to more than 3 million gallons.

A Water Consumers' Defence Association has been formed in the East-end with the following objects: "(1) Control of the water supply of London by the London County Council; (2) to provide legal aid to all members who will refuse to pay rates for water not supplied, and against whom action may be taken by the East London Water Company. All ratepayers who are prepared to resist the payment of water-rates are requested to communicate with the Association in order to ensure an organized combination to resist the unjust demands of the East London Water Company."

Mr. C. E. Jones, the late Gas and Water Engineer of Chesterfield, who now resides at Leyton, takes, as would be expected of him, a very commonsense view of the present water difficulty. He spoke on the subject at the meeting of the Woking Water Company last Tuesday—a question having been previously asked by a shareholder as to whether the Company proposed charging the consumers the full amount of their rate seeing that the supply of water had been curtailed. Mr. Jones said he lived in a district in London where they only received four hours' supply per day; and it was sufficient. An intermittent supply was, until a very few years ago, quite general in London. Then the constant service was adopted; and people did not like to go back to the intermittent service. He well remembered supplying a whole district, containing a mining

population, with 8 gallons of water per head per day; and the consumers were perfectly satisfied. But they had it by meter; and so it was to their advantage to economize. The abolition of cisterns, and the increasing sanitary notions of people, had led to a larger consumption of water; but whether it was necessary or not was a question which experience would have to prove. His own opinion was that half the water supply was a matter of waste; and he saw no harm whatever in shutting off the supply at night. The saving of waste by so doing was enormous; and he believed that, if the Company supplying the district in which he resided had shut off the water at night time two months ago, they would not have been in the dreadful state in which they now were. There had been a succession of twelve dry years; and it took a strong water company to stand against that. With regard to the payment for water during the period of the restriction of the supply, a shareholder had asked, on behalf of the consumers, for "equity" and "justice." The Act of Parliament provided that a water company should be compensated for the care, trouble, and expense to which they were put, whether they furnished a supply for three, six, or twenty-four hours; and this was perfectly just. The charge was not for the quantity of water supplied; it was a charge upon the property. The water supply was considered by Parliament to be such an important matter that the smaller property—property largely inhabited by what were known as the working classes—was rated lower than that occupied by the middle and richer classes. The water-rate was a charge upon the property just as much as the rent was. The company supplying the water had to maintain their reservoirs, pumping plant, distribution system, and staff; and then when they were short of water they were almost worried to death. He therefore thought that the question of "equity" was easily answered; and as to the question of "justice," he presumed that what was legal might be considered to be justice as well as law. To his mind, although he was a sufferer, he thought this was a very just law.

The Special Commissioner of the "Pall Mall Gazette" who has been investigating the water difficulty in the East-end for our contemporary contributed another article on the subject in its issue of yesterday week. Speaking of the reduction of the supply to four hours, he confessed that the outlook was most grave; but, while admitting that the consumer must feel the inconvenience of the shortage more, he did not think that the curtailment from six to four hours need give rise to any serious apprehensions. The Commissioner pointed out that the statistics prepared by the responsible officials of the Company prove that, since the beginning of the interruption of the constant supply, a quantity of water had been supplied sufficient to give every head of the population, in their district at least, 19 gallons per diem for purely domestic purposes; and certainly no one can contradict him in the opinion he expresses that, without wilful neglect or gross carelessness, everyone ought to be able to manage on such an allowance without endangering his sanitary well-being in the least. With the supply limited to four hours in the twenty-four, the average allowance should work out at something between 12 and 13 gallons; but this reduction is not enough to justify the description of the scarcity as a "famine," if the word have any meaning left. The Commissioner hits hard at the rhetoric of some of the platform speakers—sarcastically described as "wordy tub-thumpers"—at the public meetings which have been held in connection with the curtailment of the supply. Such rhetoric, he says, can serve no good end, and can only be intended to embitter the relationship, which is already hostile enough, between the Company and the consumer. In the East-end the Water Company and the public are, and have for a long time been, at loggerheads; and this attitude of hostility on the part of the local bodies who represent the consumer, whether justifiable or not, seems to him to be the bedrock of the present difficulty. He gives an account of an interview which he has had with the Secretary of the Company (Mr. I. A. Crookenden) regarding the reckless charges which have been made against them. One of the most grave of the assertions publicly made is that, since the constant supply was interrupted, certain houses had been without a drop of water for two and even three days. But the Commissioner himself has failed to find anyone of the several persons recounting this grievance who could give the addresses of the houses where the total failure of the supply had occurred; and Mr. Crookenden declared that no cases of the kind had come to his knowledge. Mr. Crookenden also explained that the Company had every reason to believe that an enormous quantity of water was wasted, either from sheer wantonness or from gross carelessness. The Company's Inspectors reported that, during the hours the water was running, the sewers ran a continuous stream of 12 to 18 inches in depth. It was almost impossible for the Company to check such waste. For one thing, wilful waste on the part of the consumer was difficult to prove; for another, it was impossible to have an official standing over every tap in East London for six or four hours a day. The Chairman of the Company (Mr. George Banbury) also impressed upon the Commissioner that if the new reservoirs sanctioned by Parliament last session, and which are now being constructed, had been ready, the Company would have had no difficulty in meeting even the present emergency. They would have had storage for an additional 1000 million gallons of water. "Unfortunately," added Mr. Banbury, "it is impossible to build reservoirs of these dimensions overnight." The Commissioner was further informed that the Company's main supply comes from the River Lea, after the New River Company have tapped it of the amount due to them by statute. The Lea is affected by drought sooner than any river in England. Last year about 140 million gallons reached the Company; but until the end of August this year they have only had 28 millions. Their Engineers say that a rainfall of 2½ inches would enable them to resume the constant supply. The only point on which the Directors think they have any reason to blame themselves is for their leniency in years past to the landlords. They ought to have insisted on their putting cisterns in every house supplied by the Company.

Owing to a diminution in the yield at the springs at Evesham, it has been agreed to restrict the supply of water to the town to sixteen hours a day. The yield has fallen to 193,000 gallons per day, or 43,000 gallons less than at this time last year, which is attributed to the dry winter.

Reductions in Price.—On the advice of the Gas Committee, the Lincoln City Council have resolved to reduce the price of gas from 2s. 3d. to 2s. 1d. per 1000 cubic feet from the 29th inst. The Andover Gas Company have reduced their charge by 3d. per 1000 cubic feet.

METROPOLIS WATER SUPPLY.

Sir B. Baker and Mr. Deacon's Report on "The Sources of Supplemental Supply."

The London County Council have issued the report by the above-named eminent Engineers on their investigations and calculations as to the projected scheme of water supply for the Metropolis from Wales. Sir Benjamin Baker and Mr. G. F. Deacon also entered fully into the whole question of the practicability, and the cost, of carrying out schemes of storage for providing 200, 300, and 400 million gallons of water per day respectively from the Thames, on the lines of the report of the Royal Commission of 1892-93. The general conclusions at which they arrived were as follows:—

(1) That for the next 10 or 15 years the Thames must necessarily remain the chief source of supply for London.

(2) That, together with the wells and probably the Lea, the Thames will always be maintained as an alternative or contributory source of supply, if for no other reason than that set forth by the Duke of Richmond's Commission—viz., the undesirability of any change by which the Metropolis would become dependent upon a single source of supply which might be liable to accidental interruption.

(3) That the evidence brought before the Royal Commission as to the quality of the existing supply, when perfectly filtered, shows that there is no reason for entirely abandoning the present sources of supply, though views differ in deciding as to the maximum quantity that may be taken from the Thames with impunity.

(4) That the practical question for decision within the next year or two is whether 12 to 15 years hence the additional supply shall come from the Thames or from Wales.

(5) That the personal prejudices and sentiments of the public—rather than the opinions of engineers, chemists, and accountants—are the most powerful factors in deciding such questions; and therefore it is not necessarily a wise course to accept the lowest tender, and take an inferior article where water supply is concerned.

(6) Personally, we should feel no hesitation in deciding that the additional supply of water should, as far as possible, come from Wales, because we should then, in our opinion, have had all reasonable regard both to true economy and to existing and future prejudices and sentimental or real objections to an initially polluted and subsequently more or less purified supply. We should, in short, be doing for the population collectively what we should be doing for ourselves individually in going to a pure spring, if there was one reasonably available, for our own domestic supply, although it might involve a little more trouble and expense.

(7) The extra trouble and expense to individual householders in London of getting the additional supply of water from the purest source available, rather than out of the nearest stream, would be insignificant, compared with that willingly incurred by country residents and cottagers for the same object, since, on the basis of the figures given in this report, the first 200 million gallons a day would involve an additional expenditure of less than 1d. per week for an average household; while for the second instalment of 200 million gallons Welsh water would be the cheaper of the two.

The Water Committee of the Council add that, pending the sittings of the present Royal Commission on Water Supply, they have postponed the consideration of this report; and the work connected with the question of a supplementary supply of water from Wales has been confined principally to proceeding with the plans and sections of the Wye portion of the scheme.

MANCHESTER CORPORATION WATER SUPPLY.

Reduction in the Charges—The Position of the Thirlmere Works

At the Meeting of the Manchester City Council last Wednesday, the Water Committee reported that, after careful investigation of the financial position of the department, they were able to recommend that the surplus revenue be appropriated as follows from April 1, 1899: That the public water-rate be reduced 2d. in the pound; that the charges for water for domestic purposes be reduced 1d. in the pound; and that 5 per cent. discount be allowed off all accounts for supplies of water by meter amounting to 10s. per quarter and upwards, on condition that such accounts were paid within a specified period, to be afterwards fixed. These reductions, amounting to a total of about £35,000 per annum, would probably exhaust the accruing surplus during the next few years; and, should the financial position of the department, at the end of that time, allow of a readjustment, it was recommended that the charges for water by meter be again taken into consideration, with a view of a further reduction being made, as this largely affected the trade of the district. The Committee remarked that they were much gratified in being able to make these reductions, considering the large expenditure incurred in carrying out the Thirlmere works. The works were commenced in 1886, and would eventually supply 50 million gallons per day and provide for 160 days' consumption at that rate, even without any rainfall. The total length of aqueduct was nearly 96 miles. Of this 14½ miles of "tunnel" and 36¾ miles of "cut and cover" had been constructed large enough for the whole 50 million gallons per day. For the remaining 45 miles, a single pipe, capable of conveying 10 million gallons per day, had been laid; and this would be supplemented by additional pipes, each to carry 10 million gallons per day, as occasion required. The total capital expenditure on the Thirlmere works so far amounted to rather more than £2,696,000. This included the purchase of 11,000 acres of land forming the watershed, as well as all interests therein of every description, and the wayleave for the aqueduct. The Corporation thus owned the freehold of the whole of the watershed, which consisted mostly of mountain land and farms. Suitable arrangements had been made for the management of the works; and everything in connection therewith was working exceptionally well. The report was adopted.

STOCKPORT CORPORATION AND THE WATER COMPANY.

Revival of the Purchase Question.

At a Special Meeting of the Stockport Town Council on Monday last week, the following motion was discussed: "That, in the opinion of this Council, it is desirable to acquire the undertaking of the Stockport District Water-Works Company."

Alderman W. Lees, the Chairman of the Finance Committee, proposed the adoption of the motion. He said that the subject had been before the Council on various occasions during the last forty years; but the financial aspect of the question had up to now debarred the Corporation from acquiring the undertaking. He had no hesitation, having given the matter great consideration for several years, in asking the Council to take it up earnestly with a view to purchase. The object of giving municipal corporations more control was to promote the health, good government, and well-being of the people; and it could not be denied that water was one of the first necessities of life. He hoped nothing would be said to cause friction between the Corporation and the Company. The Company stepped in the breach, and supplied a public necessity when the municipal life of the borough was not sufficiently vitalized to undertake the duty. Of course, private water companies were not to be considered in the light of philanthropists; their object was to secure the best possible dividend upon their investments. He said nothing as to the quantity or quality of the water supply, which had been improved during recent years; but as the population of the town and district increased, it became more necessary that the water supply should be in the hands of the Corporation. When this question was last seriously considered, in 1886, it was said that a rate of at least 1s. in the pound would have to be levied to make up the deficiency; but he thought the estimate then formed was incorrect. He had satisfied himself that there would probably never be a more favourable time, and that, by methods now open to them, they might acquire the undertaking for an extra rate of a few pence in the pound at the commencement, which extra rate would gradually pass away. The Company's present supplies were as follows: Lyme Park reservoirs, 1,250,000 gallons; Manchester Corporation reservoirs, 1,100,000 gallons (the price paid being 2½d. per 1000 gallons for a quantity not exceeding 1,000,000 gallons, 6d. per 1000 for the Bredbury supply, and 8d. and 9d. per 1000 for any further quantity required); and 750,000 gallons from the new well at Wilmslow—making a total supply of 3,100,000 gallons for a population approximately estimated at 150,000. He understood it was usual to have a supply calculated to meet the probable requirements of the district ten years hence. They might be told, therefore, that it would be necessary to provide new works, to which his reply was that these new works could be undertaken by a corporation on better terms and more effectually than by a private company. From a sanitary point of view, it was important that the Corporation should have control of the water supply; and the Government were now most favourable to the transfer of such undertakings to municipal authorities.

Alderman John Turner, Vice-Chairman of the Finance Committee, seconded the motion—remarking that, if it was right that the Corporation should have control of the gas supply, it was tenfold more important that they should have control of the water supply. The object of the Corporation would not be solely to make dividends. They had to remember that their first duty was to preserve as far as possible the health of the people. The suburbs of Stockport were being covered with property, the area of the gathering-ground was being built upon, and the sources of supply would be much curtailed if they did not move early.

Mr. T. Hidderley said that, on the last occasion this question was discussed, it was found that the purchase would involve a rate of 1s. 2½d. in the pound; and, after the transfer, the difficulty would be that the public would want a better supply at a cheaper rate. He believed it was misleading to say that the purchase would mean only a few pence extra on the rates.

Messrs. Burrows and Lievesley having spoken in support of the motion, it was unanimously agreed to.

A Committee was afterwards appointed to negotiate with the Company.

DEVONPORT CORPORATION AND THE WATER-WORKS.

A Purchase Bill Agreed Upon.

A Special Meeting of the Devonport Town Council was held last Tuesday to consider the recommendation of the Water Committee that application be made to Parliament for power to compulsorily acquire the undertaking of the Devonport Water Company. The Mayor (Mr. W. J. Waycott) presided.

Mr. H. Whitfeld, the Chairman of the Water Committee, moved the adoption of the Committee's report. He said the town was unanimous as to the propriety of the step; and the only difference would be as to the wisdom of the step from the financial standpoint. If it had been possible to purchase the works 25 years ago, the undertaking could have been obtained for a much smaller sum; and if it were left for 25 years more, its value would have increased out of all proportion to the figures they had to take into their calculation now. The Committee had made overtures to the Company, and had offered by stages the maximum dividends, which in any case they would be entitled to earn if they continued as a Company for all time. These overtures had been rejected; and they could only conclude that the Company's one and substantial reason for refusing to sell was the enormous capitalization of their effects that was constantly in progress. The Company must be on the eve of making very large additions and alterations to their plant. It was expected that the Devonport leat must be piped from end to end. The Company must also create a large storage reservoir to take the place of the smaller reservoirs which it had hitherto been the policy of the Company to construct—a policy which was not considered wise by those who had advised the Committee. If that money must be spent, it should be spent by the Municipality, and not by the Company. The Committee had no strong feeling in the matter. They threw on the Council and the town the responsibility of rejection, if rejection was to be the policy of the town. They did not pretend that the purchase of the water undertaking would not constitute a charge upon the rates. They were, however, advised that it would be from the outset a diminishing charge; and they were confident it would be met by an increase of revenue arising from an increase of population. The scheme was the one means within a few years of relieving the rates, and was the great means by which Devonport might begin to municipalize all the articles common to the consumption of its inhabitants.

Mr. Chew seconded the motion.

Mr. Banbury moved, as an amendment, that the question be considered that day twelve months. He complained that Mr. Whitfeld had given the Council very little data, and said they could not contend with Devonport that the water was bad or the supply intermittent. If the undertaking cost only half a million—and he believed it would cost a great deal more—the annual charge would be £22,500. The gross income of the Company was something under £13,000; and if they took the net income at £6000, and subtracted this from the £22,500, they would have a deficiency which would be equal to a rate of 1s. 5d. in the pound in addition to the present charges for water.

Mr. Stephens seconded the amendment.

Mr. Harvey said the Company were not a bit afraid of the proposal; and the Corporation had not the slightest chance of getting the works. If they should succeed, the ratepayers must be prepared to pay a heavy rate, and the cost of water would be about 25 per cent. higher than now.

Mr. Emdon believed the cost of the works would be from £450,000 to £500,000, which would mean an immediate rate of 1s. 0½d.—a probable rate of 1s. 3d. Delay would not enhance the value of the works.

The Town Clerk, in replying to a question, said retaining fees would be paid to certain counsel and engineers, who had been retained. The disposition of Parliament towards the purchase of water-works had undergone considerable change during the last 25 years. If the works could be bought upon a system of annuities, the question of purchase money would not arise. The maximum dividends of the Company ranged from 14 to 6 per cent.

Mr. Rolston, while in favour of the principle that the water supply should be in the hands of the Corporation, said he was not prepared to ask the ratepayers to pay an outrageous sum for the principle. Of 48 members of the Council, only 26 were present; so that there did not seem to be a very strong feeling on the subject. It was preposterous to engage counsel, and enter into other expensive arrangements, without knowing whether or not the ratepayers would endorse the proposal. The speech of Mr. Whitfeld would only "bamboozle" them.

Mr. Hornbrook was of opinion that delay would make purchase more difficult.

Mr. James said it was for the ratepayers to decide; but they should be supplied with data, which would enable them to come to a conclusion.

Mr. Whitby thought the time inopportune for the purchase. The rates were now 5s. 2d., and would be 6s. 2d.; and if 6d. were added on account of the water-works, that would mean 6s. 8d., in addition to which their assessments had been increased 33 per cent.

Other members having spoken in opposition to the proposal,

The amendment was put and defeated by 13 votes to 9—four of the members being neutral. Another amendment to the effect that the Committee should be asked to consider the matter with a view to furnishing data which would help the Council, was defeated by 13 votes to 10; Mr. Whitfeld remarking that the Town Clerk advised the Committee to "sit tight," and not give information the Company could take advantage of. The resolution was finally carried, but with several dissentients.

WOKING WATER COMPANY.

The report which was submitted at the half-yearly meeting of this Company last Tuesday, stated that the revenue for the six months had been £3881; and the expenditure, £1498. The amount carried to profit and loss account was £2383, which gave a balance available for division of £2445. From this the Directors recommended the payment of an interim dividend at the rate of 4 per cent. per annum, which would absorb £1565, and leave £880 to be carried forward. Commenting upon the report, the Chairman (Mr. Charles Horsley) said the business was increasing satisfactorily. But he was sorry that the unusual drought had compelled the Directors to reduce the supply of water to thirteen hours per day. Other companies, however, with larger resources than they had, were unable to provide a constant supply; and all over the country there was a shortness of water. The Directors had been for some time engaged in negotiations whereby they hoped to obtain an appreciable addition to their present source of supply; but they had not been brought to a satisfactory conclusion. If they could not get the site they wanted, they would have to take steps to secure another one. The reservoir which had been constructed at Clandon, to contain 500,000 gallons of water, was now completed. Under present circumstances, the Directors had gone to some little expense in opening up the first well, which they previously left. They were getting from 10,000 to 15,000 gallons of water per day from it; and if they could obtain from 20,000 to 25,000 gallons, it would be a considerable help. He also referred to a matter which was explained more fully by Mr. R. Hesketh Jones in seconding the motion for the adoption of the report. He said it would be recollected that some time since the Company ceded a portion of their district to the Frimley Water Company, in consideration of the payment by them of £5000 worth of their shares, which, however, were not to receive any dividend until the Frimley shareholders obtained 5 per cent. The Frimley Company having occasion to go to Parliament in the past session, the Directors thought it would be a good opportunity to get clear of the shares; and after a good deal of negotiation, they had succeeded in making an arrangement by which they would receive from the Frimley Company £4500 for them. Mr. C. E. Jones made some remarks on the general question of the drought and water supply; and these will be found recorded in the article on "The Dry Weather and Water Supply." The report was adopted, and the dividend recommended declared. At a subsequent extraordinary meeting, the Directors were authorized to raise the additional sum of £10,000, by the creation and issue of new ordinary £10 shares, and to borrow £2500.

HALIFAX NEW WATER-WORKS SCHEME.

By a resolution on the *agenda* at the meeting of the Halifax Town Council last Wednesday, the Water Committee sought to be authorized to carry out forthwith the construction of the Walshaw scheme of water-works, authorized by the Corporation Act of the past session, at an estimated cost of £157,000. Mr. Josiah Wade, the Chairman of the Committee, in moving the adoption of the minutes, reminded the Council that they decided a year ago to go to Parliament for powers to carry out the Wishaw scheme. Having now obtained authority, it would be wise to begin the work at once; for were a dry season to come, there would be a risk of scarcity in the supply. The total requirements amounted to 4,350,000 gallons per day. The present storage system gave them (say) 4,624,000 gallons per day; showing a very narrow margin. If they began the work of construction now, it would take eight years to complete it; and their powers only extended to ten years. Mr. C. Parker having seconded the resolution, the discussion was adjourned to a special meeting.

CARNARVON WATER SUPPLY.

Sources of Pollution.

A report has recently been presented to the Local Government Board by Dr. S. W. Wheaton with reference to the sources of water supply for the borough of Carnarvon, which has for some years past been unsatisfactory, more particularly by reason of its liability to pollution by liquid refuse coming from the village of Rhyd-ddu. The supply is obtained from the River Gwyrfai, which issues from Llyn-y-Gader as a large stream, and, 3 miles lower down the valley, falls into Lyn Quellyn. At the intake, 6½ miles distant from the town of Carnarvon, the water flows from a dam through copper gauze screens directly into an iron pipe, by which it is conveyed, without filtration, to a reservoir constructed 2½ miles outside the borough. The whole of the Gwyrfai Valley above the intake is occupied by farms; and, with one exception, these are situate on the banks of a stream which falls into the River Gwyrfai. Dr. Wheaton describes the sanitary surroundings of the farms and other buildings whose sewage is suffered to pollute the source of water supply for the borough of Carnarvon, with its population of nearly 10,000, and states that the Gwyrfai is allowed to receive the whole of the liquid refuse from the village of Rhyd-ddu, which has a population of about 150 persons. There can be no doubt, he adds, that the sanitary circumstances of the village are such as to form a serious danger to the consumers of the water from the Gwyrfai River; and there would be grave risk to such consumers should enteric fever or cholera at any time break out in the village. The two authorities in whose districts the village is situated—the Gwyrfai and Glaslyn Rural District Councils—have up to the present failed to come to any arrangement for a joint system of sewerage, though there can be no doubt that combination for this purpose is indicated by the local circumstances. Each Council has caused plans to be prepared for the sewerage of that portion of the village which is under its jurisdiction; but nothing further has been done. Dr. Wheaton's inquiries led him to the conclusion that the work of preventing pollution of the Carnarvon water supply is a very difficult undertaking, requiring the exercise of constant vigilance over a very large area. Doubting whether filtration, as ordinarily carried out, can, in the present condition of the supply, be trusted to secure a uniformly wholesome water, he indicates the further measures which are necessary before such a result can be attained; but he expresses his preference for Lyn-y-Aywarchen as a source of supply, which is almost entirely free from risk of pollution. At the present time the water of the last-mentioned lake is not used for any purpose.

PREVENTING THE POLLUTION OF WATER SUPPLIES.

Readers of the "JOURNAL" are aware that the above subject has been brought very much to the front during the past twelve months. An opinion has been pretty freely expressed that there should be some general legislation with the view of protecting sources of water supply; and, though the proposals in this direction put forward by the Local Government Board, which have recently been dealt with in our columns, were abandoned last session, there is every reason for believing that some general Bill will be introduced next year to remedy what are regarded as existing defects. The subject is one of far-reaching importance; and it is arousing attention in other countries than our own. We learn from the "Engineering Record" that Baltimore is now passing through one of those periods of agitation which are bound to occur in communities relying upon surface waters for their supply. The city is furnished with water from two streams. The first is Jones's Falls, impounded in Lake Roland; the second, the Gunpowder, impounded in Loch Raven. It has recently been estimated that, without considering the storage capacity of the reservoirs and the periods of turbid water, the former supply falls about 10½ million gallons a day short of the demands made upon it in times of minimum discharge; while the latter exceeds by about 33 million gallons the draught on it during similar periods. The supply from Lake Roland recently became decidedly unpleasant; and an examination of the watershed was made by Mr. G. P. Hopkins, of the Water Department. He found all the tributaries of the lake badly polluted; and he reported that there was hardly a sink or a barnyard near these lakes which was not connected with them directly by pipes. Outhouses overhung the channels in many places; and other sources of danger to the water supply were often found. The reports read very much like those made a few years ago concerning the watershed of the New York supply; and this similarity naturally suggests that the remedy adopted by the community of the larger city may be found efficient for that of the smaller one. Baltimore may abandon the Lake Roland supply, and yet have enough water for some time to come. But the city is growing so rapidly that such a course seems hardly desirable. An ample supply of water is necessary for the success of any community; and the Lake Roland supply, guarded against nuisances along the lake and its tributaries, and filtered before delivery to the consumers, might enable that city to tide over accidents to the Gunpowder supply which would otherwise cause serious annoyances. Whether the city will require any special legislation to enable it to abolish these nuisances is a subject for lawyers rather than engineers; yet a decision on this question recently given by the Supreme Court of New York is so important that it may be briefly reviewed.

Under the provisions of chapter 490 of the New York State laws passed in 1883, the Commissioner of Public Works of the City was directed to prepare plans and maps for the construction of a new aqueduct, "and for the construction of one or more dams and reservoirs to detain such water, and for the construction of such sluices, culverts, canals, pumping works, bridges, tunnels, blow-offs, ventilating shafts, and other appurtenances, as may be necessary to the proper construction, maintenance, or operation of such aqueduct, dams, and reservoirs." These maps and plans were to be filed and open to public inspection; and the works were to be constructed according to them. The owner of a portion of the property indicated as necessary for one of the reservoirs objected to its being taken for two reasons. The first was that the land was not required for the "construction, maintenance, or operation" of the reservoir, and that consequently there was no authority for its appropriation by the city; and the second was that the Act was unconstitutional. The latter claim was set aside in conformity with previous decisions in the State, while the former was discussed at some length.

The Act mentioned provides that the Commissioners of Appraisal appointed by the Court shall take, subscribe, and file the constitutional oath providing for the faithful discharge of their duties, and, upon such filing, "the said Mayor, aldermen, and commonalty of the City of New York shall be and become seized in fee of all those parcels of real estate which are on the maps in the fourth section referred to described as parcels of which it has been determined by said Aqueduct Commissioners that the fee shall be acquired." The decision of the Commissioners, as indicated in the filing of the plans and other papers, was therefore final and conclusive as to the lands necessary to carry out the purposes of the Act. They were not confined to an area which would be overflowed because of the construction of a dam, for they could take whatever area was necessary for the maintenance and operation of the works as well. "This includes the taking of lands which were likely to be overflowed even in extraordinary freshets, or which were necessary to protect the water supply from pollution or injury."

The testimony in the case showed that considerable land was taken outside the high-water line of the reservoir "for the purpose of securing the waters to be contained in the reservoir from pollution around the borders, and for the purpose of securing a certain amount of property over which the city will have jurisdiction, so as to prevent nuisances from establishing themselves near the flow-line." It was stated by the Chief Engineer of the New Croton Aqueduct Commission that such zones were maintained about all the reservoirs in the Croton watershed, except in the case of the old Croton Lake. The bad results of neglect in this instance were noticed every year. The water supply of New York is still further protected by an Act passed in 1893, which provided that the Commissioner of Public Works might, within three years of the passage of the Act, take proceedings to acquire title to any real estate "for the sanitary protection of all rivers and other watercourses, lakes, ponds, and reservoirs in the counties of Westchester, Putnam, and Duchess, so far as the same now are, or hereafter may be, used for the supply of water for the City of New York." Under this law, all nuisances can be abated without delay; but the decision on the appeal in the case reviewed shows that the old law of 1883 was sufficient for the purpose.

THE WATER SUPPLY AND DRAINAGE OF SCOTTISH BURGHS.

Just before the prorogation of Parliament, a Bill was introduced into the House of Commons by the Lord Advocate and Mr. Anstruther, to amend the law in regard to the sewerage, drainage, and water supply of burghs in Scotland. It consists of only eight clauses. It is proposed to vest all sewerage, drainage, and water supply works in the Town Councils and Commissioners under the Burgh Police (Scotland) Act, 1892. Where sums of money have been borrowed or are owing by any Town Council or Commissioners of a burgh as the Local Authority under any Public Health Act for purposes of sewerage, drainage, or water supply, the Town Council or Commissioners, as the authority under the Burgh Police Act, are to provide the sums necessary for repaying the principal and paying the interest on such sums out of special sewer and water assessments to be levied. These together are not, in any burgh or special drainage district, to exceed, as a general rule, 4s. in the pound. If, however, the produce of this rate is insufficient to meet the expenditure (including the annual charge for interest and repayment of debt) actually incurred or contemplated, the rate is to be increased to such an extent as may have been approved of by the Local Government Board for Scotland. Special drainage districts formed under any Public Health Act are, subject to the provisions of the proposed Act, to be deemed special drainage districts under the Act of 1892; but special water supply districts partly within a burgh and partly within a county are not to be affected. If any difficulty should arise in regard to the transfer of works, the Local Government Board for Scotland may, after inquiry, make such orders as they may deem necessary for altering or giving effect to the abolition of special districts formed under any Act, or otherwise providing for the removal of such difficulties. The Town Council or Commissioners of any burgh, as the authority under the Burgh Police Act, 1892, in addition to the powers conferred upon them by that or any other Act, are, with reference to sewerage, drainage, or water supply, to have the same rights, powers, and privileges as are conferred by the Public Health (Scotland) Act, 1897, upon Local Authorities under that Act in districts other than burghs; and in so far as is necessary for giving effect to this enactment, the last-mentioned Act and the Acts and parts of Acts incorporated therewith are, subject to the necessary modifications, to be incorporated with the Burgh Police Act. All costs and charges incurred by the Town Council or Commissioners are to be provided for out of the assessment before mentioned; and where it shall be necessary for the Council or Commissioners to borrow money for the purposes of sewerage, drainage, or water supply, they are to be entitled to do so on the security of the assessment in lieu of the assessments mentioned in the Act of 1892, and that Act and the schedules thereto are to be read and construed accordingly. Certain sections of the Act, as well as of the Public Health (Scotland) Act, 1897, are to be repealed. The Bill under notice was only read the first time.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

With the holding of the Waverley Association meeting at Duns on Thursday last, the gatherings of Scotch gas managers are wound up for the year. I am satisfied a more useful series of meetings has never been held. The subjects discussed may not have been so striking as has sometimes been the case; but they were, on that account, probably more within the reach of the larger number of managers than if they had been of a higher order. The spirit of comradeship, of helpfulness, which was displayed, was, however, the leading feature of all the meetings; and it is a feature which is exceedingly pleasant to behold. The Waverley Association is the one in which the members come nearer to each other than is perhaps the case in any other body of the kind. The members—at least those of them who attend the meetings—are all managers of works of small size; and their experiences are consequently to a large extent similar. Each is therefore able to contribute something for the common good. There is a further bond of unity in the Waverley Association in the belief that theirs is the parent of all the Associations. On this subject, whatever question there may have been, it would seem to be now dispelled, and the claim of the Waverley to be the pioneer to be established. Mr. Adamson's remarks at the dinner are conclusive, unless there be documentary evidence to the contrary, which is not likely to exist, or it would have been produced already. The spring meeting of the Association is to be held in Edinburgh, on the second Thursday of April. The autumn meeting is to be at Melrose, on the second Thursday of September. A more delightful spot, or one more appropriate for the holding of a Waverley Association meeting, could not be selected; it being adjacent to Abbotsford, the home of the great author of "Waverley." This circumstance may be expected to stimulate the zeal of the members. There should, considering the attractions, be a good attendance at both next year's meetings. The remark is not confined to the Waverley, but applies to all Associations, that those who do not attend the meetings are not aware of how much they lose.

The Aberdeen Corporation gas accounts, of which a summary has been given in this column, were before the Town Council at a meeting on Monday. Mr. Johnston, the Convener of the Gas Committee, who presented them, said: "The income from the sale of gas was £70,276, or £1166 less than last year; but you must remember that a reduction of 2d. per 1000 cubic feet took place, which would be equal at least to very nearly £4000. The amount of revenue has exceeded the estimate by £451. The income from residual products amounted to £9960, an increase of £938 over the previous year, and of £560 over the estimate. This, with the income from other sources, amounts to a grand total of £83,203; being an increase over the previous year—notwithstanding the reduction of 2d.—of £2201. The amount of coal carbonized was 49,179 tons, and the average price per ton 14s. 10d.—an increase of 2134 tons over the previous year. The amount paid for coal was £36,494, which, with other expenditure, amounted to £64,733, or £6932 less than last year. But notwithstanding this there is a handsome balance of £18,469 to be carried to the net revenue account. After meeting all charges, payment of annuities, interest on mortgages, sinking fund, and a larger sum by £1556 than has ever been set aside in any one year since the Corporation took over the gas-works for the redemption of gas annuities, there is still a balance of £2210, which, with the sum brought from last year's account, gives the net balance to be carried to next year's account of £5864. The reserve fund now amounts to £20,503 15s. 11d.; and it will be in your remembrance that in my remarks last year I mentioned that a new valuation of the whole undertaking had been made, and would be incorporated in the accounts for the following year. This has now been done; and the figures in the capital account show the actual value of the works. This value is brought out at £278,581 15s. 2d., which is a very large increase on the figures (£151,000 odd) which represented the book value of the undertaking last year. An estimate of the revenue and expenditure has been prepared and based on the assumption of selling 448 million cubic feet of gas at 3s. 1d. per 1000 cubic feet. It is calculated that the revenue will amount to £79,566, and the expenditure to £81,625; thus drawing upon the present surplus by about £2000, but still showing a balance on the right side of £3800, which will, I think, be admitted a fair surplus for any contingency that may arise. It is interesting to note the progress of the undertaking from 1871, the year the Council took over the works. The manufacture of gas for that year was 146 million cubic feet, producing £33,100. The figures for the year just ended are 494 millions, bringing in £70,276. The manufacture has thus considerably more than trebled itself, while, on account of the gradual reduction in the price charged, the income has only been a little over double—thus controverting a common phrase that the reduction in the price of gas makes no difference to the gas bill of consumers. I now beg to propose that the price of gas be reduced by 1d. per 1000 cubic feet, making the price 3s. 1d., with the usual discount. I must add that the Committee, along with myself, have to congratulate Mr. Smith, Mr. Cran, and the whole staff on the good results brought out in conducting this large undertaking, the income of which, along with the electric undertaking, is about equal to the assessment on the whole city and water-rate. Taking into account the great distance we have to carry our coal, besides other large cities in the South, I think the statement must be very satisfactory to everybody." Mr. Johnston concluded with the remark that the undertaking was well managed and well conducted—an opinion which his statement of the accounts quite bears out. The Corporation give discounts to the amount of 1d. per 1000 cubic feet for gas consumed of not less than 35,000 and under 50,000 cubic feet; rising to 6d. for gas consumed of over 4 million feet.

The Corporation of Inverness on Monday adopted the recommendation of Mr. J. Thomson (the Gas Manager) to reduce the price of gas from 3s. 9d. to 3s. 4d. per 1000 cubic feet. The number of consumers is yearly increasing; and last year the output rose by 6·84 per cent.

The annual meeting of the shareholders of the St. Andrews Gas Company was held yesterday. Mr. Jesse Hall, the veteran Manager of the Company, reported that the income from all sources had been £5723, and the total expenditure £4358; leaving a balance of profit of £1365. Gas manufactured amounted to 33,789,000 cubic feet—an increase of 1,287,000 cubic feet over the preceding year. The new works which are nearly

GAS AND WATER COMPANIES STOCK AND SHARE LIST.

Referred to on p. 580.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
590,000	10	Apl. 15	10½	Alliance & Dublin 10 p. c.	22½—23½	..	4 9 4
100,000	10	,,	7½	Do. 7 p. c.	16½—17½	..	4 5 9
300,000	100	July 1	5	Australian 5 p. c. Db.	105—107	..	4 13 6
200,000	5	May 26	6	Bombay, Ltd.	6½—7	..	4 5 9
40,000	5	,,	6	Do. New, £4 paid	4½—5	..	4 16 0
380,000	Stk.	Aug. 12	12	Brentford Consolidated	275—280	..	4 5 9
240,000	,,	,,	9	Do. New	210—215	..	4 3 9
50,000	,,	,,	5	Do. 5 p. c. Prf.	140—145	..	3 9 0
159,375	,,	June 10	4	Do. 4 p. c. Db. Stk.	130—135	..	2 19 3
220,000	Stk.	Mar. 30	11½	Brighton & Hove Orig.	268—273	..	4 4 3
226,320	,,	,,	8½	Do. A. Ord. Stk.	195—200	..	4 5 0
933,500	Stk.	Aug. 31	5	Bristol, 5 p. c. max.	125—130*	..	3 16 11
420,000	20	Mar. 30	10†	British	51—53	−1½	3 15 6
50,000	10	Aug. 12	11½	Bromley, Ord. 10 p. c.	25—27	..	4 5 2
75,000	10	,,	8½	Do. 7 p. c.	20—22	..	3 17 3
500,000	10	Apl. 29	6	Buenos Ayres (New) Ltd	9—9½	..	6 6 4
98,122	Stk.	June 29	4	Do. 4 p. c. Db. Stk.	98—100	..	4 0 0
150,000	20	July 14	8½	Cagliari, Ltd.	29—30	..	5 10 0
100,000	10	June 10	7	Cape Town & Dis., Ltd.	15—16	..	4 7 6
50,000	50	May 3	6	Do. 6 p. c. 1st Mort.	58—60	..	5 0 0
550,000	Stk.	Apl 15	13½	Commercial Old Stock	315—325	..	4 3 1
200,750	,,	,,	10½	Do. New do.	252—257	..	4 1 8
200,750	,,	June 10	4½	Do. 4½ p. c. Db. do.	148—153	..	2 18 10
600,000	Stk.	June 10	12	Continental Union, Ltd.	207—212	..	5 13 2
200,000	,,	,,	9	Do. 7 p. c. Prf.	197—202	..	4 9 1
51,600	Stk	Aug. 31	14	Croydon A 10 p. c.	305—310*	..	4 10 4
168,400	,,	,,	11	Do. B 7 p. c.	255—265*	..	4 3 0
555,000	Stk.	Aug. 12	5½	Crystal Palace Ord. 5 p. c.	125—130	..	4 0 9
60,000	,,	,,	5	Do. 5 p. c. Prf.	140—145	..	3 9 0
486,090	10	July 28	11	European, Ltd.	23—24	..	4 11 8
854,060	10	,,	11	Do. £7 10s. paid	16½—17½	..	4 14 4
5,922,230	Stk.	Aug. 12	12½	Gaslight & Coke, A, Ord	288—293	−2	4 3 6
100,000	,,	,,	4	Do. B, 4 p. c. max.	120—125	..	3 4 0
665,000	,,	,,	10	Do. C, D, E, 10 p. c. Prf.	305—310	..	3 4 6
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	152—157	..	3 3 8
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	230—240	..	3 2 6
1,900,000	,,	,,	7	Do. H, 7 p. c. max.	195—200	..	3 10 0
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	305—310	..	3 4 6
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	182—187	..	3 4 2
1,061,150	,,	June 10	4	Do. 4 p. c. Db. Stk.	131—133	..	3 0 2
294,850	,,	,,	4½	Do. 4½ p. c. do.	148—153	..	2 18 10
958,000	,,	,,	6	Do. 6 p. c. do.	198—203	..	2 19 1
70,000	10	May 12	8	Hongkong & China, Ltd.	14—15	+½	5 6 8
3,800,000	Stk.	,,	10	Imperial Continental	215—220	+3	4 10 11
376,400	100	Aug. 2	4	Do. 4 p. c. Dbs. Red.	98—101	..	3 19 8
473,600	Stk.	Aug. 12	3½	Do. 3½ p. c. Db. Stk. ,,	101—104	..	3 7 4
560,000	100	Apl. 1	5	Met. of Mel-bourne	5 p. c. Db.	111—113	..	4 8 10
					4½ p. c. Db.	107—109	..	4 2 7
250,000	100	,,	4½				

* Ex div.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
75,000	5	June 29	6	Malta & Medn., Ltd.	4⅞—5⅛	..	5 14 3
541,920	20	June 10	5	Monte Video, Ltd.	13½—14½	−½	6 18 0
617,946	Stk.	Aug. 31	9¾	Newc'tle & Gatesh'd Con.	230—240*	..	4 1 3
252,375	Stk.	Jan. 3	3½	Do. 3½ p. c. Db. Stk.	113—117	..	2 19 10
150,000	5	May 26	8	Oriental, Ltd.	7⅞—8	+⅛	5 0 0
135,000	5	,,	8	Do. New, £4 10s. pd.	6½—7	..	5 2 11
15,000	5	,,	8	Do. do. 1879, £1 pd.	1¼—1⅜	..	4 11 5
60,000	5	Mar. 11	7	Ottoman, Ltd.	⅝—¾	..	6 6 2
500,000	100	June 1	6	People's Gas of Chicago 2nd M. Bd.	103—108	..	5 11 1
848,070	10	May 26	6	River Plate Ord.	9⅛—9⅜	+⅛	6 3 1
250,000	Stk.	June 29	4	Do. 4 p. c. Db. Stk.	99—101	..	3 19 3
250,000	10	Apl. 29	10	San Paulo, Ltd.	15—16	..	6 5 0
135,000	Stk.	Mar. 30	10	Sheffield A.	247—250	..	4 0 0
200,053	,,	,,	10	Do. B.	247—250	..	4 0 0
447,427	,,	,,	10	Do. C.	247—250	..	4 0 0
5,600,000	Stk.	Aug. 12	5⅓	South Metrop., 4 p.c Ord.	140—143	..	3 14 7
1,460,000	,,	July 14	3	Do. 3 p. c. Db. Stk.	101—104	..	2 17 8
60,000	Stk.	Aug. 31	12	Tottenham and A.	280—290*	..	4 2 9
60,000	,,	,,	9	Edmonton B.	200—210*	..	4 5 9
182,380	10	June 10	7	Tuscan, Ltd.	10½—11½	..	6 1 9
149,900	10	July 1	5	Do. 5 p. c. Dbs. Red.	100—103	..	4 17 1
				WATER COMPANIES.			
746,164	Stk.	June 29	10½	Chelsea, Ord.	313—318	..	3 6 0
150,000	,,	,,	5	Do. 5 p. c. Prf.	170—175	..	2 17 2
160,000	,,	,,	4½	Do. 4½ p. c. Pf. Stk., 1875	148—152	..	2 19 3
175,785	,,	Mar. 30	4½	Do. 4½ p. c. 1 b. Stk.	157—162	..	2 15 7
1,720,560	Stk.	Apl. 15	8	East London, Ord.	217—222	−3	3 12 1
654,740	,,	June 29	4½	Do. 4½ p. c. Db. Stk.	157—160	..	2 16 3
390,000	,,	,,	3	Do. 3 p. c. Db. Stk.	103—105	..	2 17 2
700,000	£50	June 29	7½	G'd Junct'n, 10 p. c. max.	115—118	..	3 3 7
310,000	Stk.	Mar. 30	4	Do. 4 p. c. Db. Stk.	142—147	..	2 14 5
708,000	Stk.	Aug. 12	14	Kent	364—369	..	3 15 11
160,000	,,	,,	7	Do. New, 7 p. c. max.	212—217	..	3 4 6
1,043,800	100	June 29	10	Lambeth, 10 p. c. max.	298—303	..	3 6 0
406,200	100	,,	7½	Do. 7½ p. c. max.	2 7—232	..	3 4 8
350,000	Stk.	Mar. 30	4	Do. 4 p. c. Db. Stk.	140—145	..	2 15 2
500,000	100	Aug. 12	12¾	New River, New Shares	430—435	+3	3 0 11
1,000,000	Stk.	July 28	4	Do. 4 p. c. Db. Stk.	140—145	..	2 15 3
902,300	Stk.	June 29	6	Southw'k & V'xhall, Ord.	166—171	..	3 10 2
126,500	100	,,	6	Do. do. 7½ p. c. max.	157—162	..	3 14 1
489,200	Stk.	,,	5	Do. do. 5 p. c. Prf.	168—172	..	2 18 2
1,019,585	,,	Apl. 15	4	Do. 4 p. c. A Db. Stk.	141—144	..	2 15 7
1,155,066	Stk.	June 10	10	West Middlesex	300—305	..	3 5 7
200,000	,,	,,	4½	Do. 4½ p. c. Db. Stk.	162—165	..	2 14 7
200,000	,,	Mar. 11	3	Do. 3 p. c. Db. Stk.	104—106	..	2 16 7

* Ex div.

† Next dividend will be at this rate.

completed have cost £1177, to meet which £1000 was borrowed at the rate of 3 per cent., and the balance has been taken out of the past year's accounts. The income was £180 less than in the preceding year, which was due to a reduction of 2d. in the price of gas and the receipt of a less sum for residual products. The balance-sheet showed a surplus of £1565, besides £869 which has been paid for 1096 tons of coal which is in stock and is applicable to this year. A dividend was declared at the rate of 50s. per share. Mr. Hall has been Manager of the Company since 1850. When he was appointed, there were 180 consumers on the books; there are now 1688. Ten years ago the price of gas was 5s. per 1000 cubic feet; and now it is 3s. 4d.

The Peebles Town Council on Thursday resolved to adopt the Burghs Gas Supply Act, with a view to the completion of the agreement for the transfer to them of the undertaking of the Peebles Gaslight Company. Both Provost Ballantyne, who moved the adoption of the Act, and Treasurer Williamson, who seconded, expressed themselves as confident that the step they were taking was the right one. With this view, there will be general agreement; and there should be as general satisfaction at the fact that what threatened at one time to be a costly and offensive proceeding has been, or is all but, concluded in an amicable manner. A second special meeting of the Town Council is to be held on Nov. 14, in terms of the statute, for the confirmation or rejection of the resolution to adopt the Act.

The accounts of the Dunfermline Corporation Gas Department for the past year show that the capital of the undertaking was increased from £97,880 to £99,320. Of this sum, £5700 has been raised by means of mortgage bonds, and the balance is Corporation stock. The total revenue amounted to £13,097, of which £11,414 was received for gas sold, £640 from the sale of coke, £734 from the sale of tar and ammoniacal liquor, and £309 from meter and stove rents. The expenditure included £3322 for coal and £941 for distribution of gas, and amounted to £6963—leaving a gross profit of £6134. Out of this, interest upon capital to the amount of £3050 was paid, and other charges met; and there was left as the net balance £2938. The past was the first complete year of Corporation management; the preceding year having been short of a complete twelvemonth by sixteen days. In the year, the revenue from gas amounted to £10,073; from meter and stove rents, to £272; from residuals, to £1336; and the net profit was £1742.

The Banff Gaslight Company have, since their works came under the management of Mr. W. Marshall, entered upon a period of prosperity. This is due to the renovation of plant, and its maintenance in a better state of efficiency. During the past year, the yield of gas per ton of coal carbonized was 9321 cubic feet. Of 6,301,300 cubic feet of gas made, 732,500 cubic feet, or 11·62 per cent., was unaccounted for. The average illuminating power was 26·25 candles. The quantity of gas sold was greater than in the preceding year by 18,200 cubic feet.

There has been some dissatisfaction among the users of prepayment gas-meters in Falkirk at the charge for gas consumed through them not having been reduced when a reduction was given to ordinary consumers. A deputation of the aggrieved waited upon the Gas Committee, who afterwards recommended that 3d. per 1000 cubic feet be given back to consumers using prepayment meters from and after the commencement of next quarter; the return to be made when each 1000 cubic feet is consumed. The recommendation was adopted.

The Water Committee of the Glasgow Corporation on Monday had the subject of the water-pipe contract which had been sent back to them by the Town Council under consideration. They agreed to recommend the acceptance of the offer of Messrs. R. M'Laren and Co., of Glasgow, for 1000 tons of cast-iron pipes, from 3 to 12 inches. Four offers had been received; and the lowest was found to be that sent in by Messrs. Henry Merton and Co., on behalf of Messrs. R. D. Wood and Co., of Philadelphia. The offer of this firm was to supply the 995 tons required at £4 18s. 4d. per ton; while the next lowest offer was that of Messrs. R. M'Laren and Co., £4 19s. 8d. The matter was sent to the Engineer (Mr. J. M. Gale) for report; and his report was that, as the difference in price was only 1s. 4d. per ton, representing a total of £66 7s. 4d., he did not think it was worth while going to America for the pipes.

The Wishaw Police Commissioners on Monday night considered the water scheme which they obtained parliamentary powers last session to promote. A report by the Engineer to the Commissioners (Mr. James Tait, of Wishaw) was submitted, which contained the cost of constructing a compensation reservoir, and bringing in a supply of water to the present burgh reservoirs in the parish of Carluke from the streams of Portrail, Potrinick, and Redin, in the parish of Crawford. The probable estimates were made with piping in four different diameters. The cost of carrying out the works, including land, wayleaves, and surface damages, was as follows: Reservoir, with an 18-inch pipe-line (delivering 2,200,000 gallons of water per day), £93,000; 16-inch pipe-line (1,640,000 gallons), £81,000; 15-inch pipe-line (1,400,000 gallons), £78,000; and 12-inch pipe-line (780,000 gallons), £67,000. Attached to the report was a certificate signed by Mr. R. Copland, of Glasgow, saying he had examined the estimates on which the report was based, and he considered the sums sufficient. After discussion, it was unanimously agreed to adopt the 18-inch size of pipe, at a cost of £93,000; and the Engineer was instructed to prepare specifications and schedules.

Lord Pearson, in the Outer House of the Court of Session, has issued an intermediary judgment in an action relating to the pollution of water by discharges from chemical works. The pursuers, Messrs. Robert Reid and Sons, timber merchants, of Ladybank, Fifeshire, seek remedial orders against Mr. W. Briggs, asphalte manufacturer, of Ladybank, who, it is alleged, has, by discharges from his works, caused pollution to two wells on their property, thereby rendering the waters in them unfit for primary purposes. The defence is a denial of pollution; and the case therefore depends on matter of fact—no question of principle being raised. The evidence was long and costly, as is usually the case in questions of water pollution. Lord Pearson has found that the defender has polluted the water of well No. 1 by discharging, in close proximity thereto on his own ground, large quantities of spent ammoniacal liquor, so as to render the water unfit for domestic and other natural primary uses; that the pursuers have failed to prove that any of their wells has been polluted by the defender with sulphuric acid, either in a free state or in combination;

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WINDSOR STREET WORKS, BIRMINGHAM	2,000,000	MONTREAL	500,000
SALTLEY WORKS, BIRMINGHAM	2,000,000	BELLEVILLE	250,000
COLCHESTER	300,000	OTTAWA (Second Contract)	250,000
BIRKENHEAD	2,250,000	BRANTFORD (Remodelled)	200,000
SWINDON (New Swindon Gas Co.)	120,000	ST. CATHERINES (Remodelled)	250,000
SALTLEY WORKS, BIRMINGHAM (Second Contract)	2,000,000	KINGSTON, PA.	125,000
WINDSOR STREET WORKS, BIRMINGHAM (Second Contract)	2,000,000	PETERBOROUGH, ONT.	250,000
HALIFAX	1,000,000	WILKESBARRE, PA.	750,000
TORONTO	250,000	ST. CATHERINES (Second Contract)	250,000
OTTAWA	250,000	BUFFALO, N.Y.	2,000,000
LINDSAY (Remodelled)	125,000	WINNIPEG, MAN.	500,000
		COLCHESTER (Second Contract)	300,000
		YORK	750,000

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and that they have also failed to prove that any part of the damage set forth in their statement of loss has been caused through or by the pollution of well No. 1 with spent ammoniacal liquor or any other cause for which the defender is responsible. Further, he has found that the defender has failed to prove that the remedial works executed by him are effectual to prevent the risk of similar pollution. With these findings, he appoints the case to be enrolled for further procedure, and reserves all questions of expenses. Leave is granted to reclaim to the Inner House.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Sept.* 10.

Sulphate of Ammonia.—There has again been a quiet market; but prices have been fairly well maintained—the closing quotations being £9 18s. 9d. per ton f.o.b. Hull, £10 1s. 3d. f.o.b. Liverpool, and £10 2s. 6d. f.o.b. Leith. Dealers, following their method for some months past, continue to hold aloof; but the larger makers, having contracts against which to deliver, are very firm. Among the smaller makers there is nowhere any pressure to sell; and parcels offered have been absorbed by direct demand. In the forward position, makers' quotations for October-March delivery are £9 17s. 6d. per ton, ordinary terms, f.o.b. Leith and London, Beckton terms, October-December delivery, £9 15s. per ton. Abroad, speculators are quoting the equivalent of something under these prices; but they are not taking any great liberties with the market.

Nitrate of Soda is a shade firmer on spot; and 7s. 7½d. per cwt. is now required for fine quality. Further ahead, the market is rather quiet; but shippers maintain their quotations firmly.

LONDON, *Sept.* 10.

Tar Products.—The principal feature in connection with tar products has been the steady advance in the value of pitch, the prospective outlook for which is much more encouraging. Benzols are still flat, and so is carbolic acid. Pyridine is more inquired for, and may improve.

Prices are as follows: Tar, 13s. to 17s. Pitch, east coast, 24s. 6d.; west coast, 22s. 6d. Benzols, 90's and 50's, nominal, 9½d. Toluol, 1s. 2d. Solvent naphtha, 1s. 2d. Heavy naphtha, 1s. 1½d. Crude, 30 per cent., naphtha, 4½d. Creosote, 2½d. Heavy oils, 42s. 6d. Carbolic acid, 60's, 2s. Naphthalene, pressed, 55s.; drained salts, 30s. Anthracene, nominal, "A," 4d.; "B," 3d.

Sulphate of Ammonia, after having touched about £10 5s., has now receded again to about £10, less 3½ per cent.; but it is firm at that.

The Buckley District Council and the Gas-Works.—The Buckley (Flintshire) District Council have lately offered the Gas Company £3500 for their works; but the Company consider they are worth £4750, and consequently decline to sell excepting at their own price. No doubt with the idea that they will force the Company to "climb down," the Council have resolved to apply for a Provisional Order to empower them to light the town by electricity.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—Since the commencement of the month business has been somewhat unsettled, partly owing to the advance in prices, and also to lessened requirements for house-fire purposes; while the termination of the South Wales dispute still further restricts buying for shipment, which during the last two or three months brought forward quite a pressure of orders for all classes of round coal. The advance, so far as Lancashire collieries are concerned, is, however, being well maintained; and South Yorkshire collieries, who are close competitors, are also gradually following—many of them having decided to advance their prices on the 15th. But there has still been no general move; and coal from Derbyshire and Staffordshire is still competing in outside districts at old rates. This, of course, renders the position of many Lancashire collieries rather difficult in markets where they come into direct competition with coal from other districts; but there is no anticipation that they will be in any way compelled to recede from the advanced prices they have put in force. At some collieries the better qualities of round coal have been accumulating; but as the stocks held are generally below the average for this time of year, that is not a matter of any concern. Steam and forge coals are in generally good request for inland requirements. Engine fuel is moving away readily; and supplies of these, if anything, are rather scarce, with the result that there is a decided hardening up in quotations for forward contracts. At the pit mouth, best Wigan Arley coals range from 11s. to 11s. 6d. per ton; seconds Arley, 10s. to 10s. 6d.; Pemberton four-feet, 9s. to 9s. 6d.; common round coals, 7s. 6d. to 8s. 6d.; and engine fuel, from 3s. 9d. to 4s. 3d. for lower qualities, to 4s. 9d. to 5s. 3d. for best descriptions. For shipment, there is still a moderately active inquiry; but prices are tending to ease down, buyers not being disposed to pay the special rates which were obtained last month. About 9s. 6d. per ton is now the average figure for steam coals, delivered at the ports on the Mersey.

Northern Coal Trade.—The change which was inevitable in the coal trade has begun now that the Welsh collieries are beginning to work fully. Prices are weaker, especially for steam coals; and the demand is not so great, though it gives full work to all the great pits. Best Northumbrian steam coals may now be quoted at about 11s. 3d. per ton f.o.b.; second qualities, about 10s. 6d.; and steam smalls, about 6s. Gas coals are still very firm; and the conclusion of the Shields contracts proves that good prices are being realized. The accepted tenders ranged, it is understood, between 9s. and 9s. 6d. per ton, delivered; and thus there is a very considerable advance on the prices for the past year. Occasional cargoes of gas coals are also firmly held; and high prices are quoted. Manufacturing fuel is steady, with a fair demand. Gas coke is also steady, with a fairly good demand, and prices firm.

Scotch Coal Trade.—Trade in Scotland is in somewhat of a transition state, consequent upon the settlement of the Welsh trouble. There is an expectation, in many quarters, that prices will come down considerably; but the opinion seems to be growing that little coal will be go from South Wales for a good while yet, and that consequently the winter

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will be well begun before prices are much affected. In Fifeshire, where the miners have made a demand for an advance of 12 per cent., the masters offered 5 per cent., which seems to indicate that both sides look forward to continued high prices. The men are to vote upon the master's offer. The prices quoted are: Main, 9s. 9d. to 10s. per ton f.o.b. Glasgow; ell, 11s.; and splint, 10s. 6d. to 10s. 9d. The shipments for the week amounted to 244,632 tons—a decrease of 9340 tons when compared with the preceding week (the decrease being altogether in the Forth and Fife districts), but an increase of 73,183 tons upon the corresponding week of last year. For the year to date, the total shipments have been 6,569,814 tons—an increase over the same period of last year of 1,215,777 tons.

Bury Corporation Gas and Water Finances.—The annual report of the Auditors (Messrs. C. M. Merchant and Son) upon the finances of the borough of Bury for the financial year ending March 31 last has been issued to the members of the Corporation. It shows a loss of £1607 on the gas-works and of £2794 on the water-works.

Rugby Gas Company.—At the recent meeting of this Company, the Directors reported that the receipts during the half year ended June 30 amounted to £6874; and the expenditure, to £4060—leaving a balance of £2814 to be carried to the profit and loss account. The balance-sheet was adopted; and an interim dividend at the rate of 12½ per cent. per annum was declared.

The Management of the Southport Gas-Works: The Committee Visit Widnes.—We are afraid that Mr. Isaac Carr, of Widnes, will find the honour of being the supplier of "the cheapest gas in the world" a little irksome if he is worried by many deputations from local authorities who are anxious to know "how it is done." We learn that the Southport Corporation Gas Committee, who are engaged in an investigation into the general management of their works, has paid him a visit; and we have noticed that members of other public bodies have pointed to Widnes as an example of what ought to be done locally, and have asked why it cannot be. So that no doubt Mr. Carr will shortly hear (if he has not already done so) of many others who are desirous of journeying to Widnes in quest of information. In connection with the question of the management of the Southport undertaking, it was mentioned in last week's issue that the Committee had decided to appoint an expert to report on the whole working; and we now understand that their choice has fallen on Mr. Corbet Woodall. It is reported that for the four months ending last Tuesday, by the use of clay retorts and a higher temperature, the gas per ton of coal carbonized has been increased to 10,400 cubic feet, which is equal to a reduction in the cost of production of 2d. per 1000 feet. During the same period there has been an increase of 10 million cubic feet in the quantity of gas sold, which (the working staff being the same) is equal to another 2d. per 1000 feet. With the maintenance of the system throughout the year this will mean a reduction in the capital charges for interest and sinking fund of at least another 1d. Better prices are also being obtained for the bye-products; so that the result of the year's working is likely to prove extremely satisfactory.

The Garston District Council and the Supply of Water Gas.—The Liverpool United Gaslight Company have decided to close (for the present at any rate) the correspondence with the Garston District Council on the subject of the supply of water gas. A letter announcing this determination of the Directors was read at a meeting of the Council last Tuesday. It stated that, pending the Home Office inquiry, the Company had nothing further to add to their statement and assurances contained in communications already made to the Council. Upon this the Chairman (Captain Turner) remarked: "We cannot expect anything more from the Company after our dealings with them."

Proposed Purchase of the Shipley Gas-Works by the Bradford Corporation.—In furtherance of their boundary extension scheme, the Bradford Corporation are now seriously taking in hand the question of purchasing the subsidiary gas undertakings. The Shipley Gas Company have at present supply rights in Frizinghall and Heaton within the city, in addition to their legitimate area, which includes Shipley, Baildon, and Windhill—all of which it is sought to include in Bradford. The Pudsey Gas Company have rights in Thornbury and Bradford Moor; the Clayton and Allerton Company in Allerton; while other Companies, such as the Eccleshill Company and the Cleckheaton Company, have rights in districts proposed to be abolished. The Finance and General Purposes Committee last Friday decided, in the event of the incorporation of Shipley within the city, to purchase, either by agreement or compulsorily, the undertaking of the Shipley Company; and in well-informed quarters it is regarded as inevitable that the Corporation should ultimately give similar assurances to other districts affected by the extension scheme.

Gas-Works Extensions at Selby.—On behalf of the Local Government Board, Lieut.-Col. A. C. Smith attended at the Selby Town Hall last Friday to hear evidence in regard to an application by the District Council for sanction to borrow £8400 for extensions at the gas-works. The Clerk to the Council (Mr. J. H. Bantoft), in opening the proceedings, gave some particulars as to the population and rateable value of the town. He also stated that the balance on the gas-works loan was £20,082. The present storage capacity was equal to 105,000 cubic feet; while last month the highest day's consumption was 180,000 cubic feet. Therefore the Council had practically little more than storage for half the maximum day's consumption. The Gas Manager (Mr. W. J. Mott) stated that at nightfall there was a great draw on the supply; and they were sometimes unable to keep up to the demand. Last winter, on one or two occasions, the Manager had to decrease the pressure and otherwise restrict the supply, and also ask the Railway Company to turn their lights low. The Council were under very great obligation to the North-Eastern Railway Company, inasmuch as all their signals at the station were lit by gas; and any interruption in the supply to them might be disastrous. The proposed new gasholder would have a capacity of 196,000 cubic feet; and it would be constructed with a view to two other lifts being added. This closed the inquiry. During the day the Inspector visited the works, and expressed himself satisfied with the substantial character of the additions, though he said it was somewhat irregular to commence the work before the loan was sanctioned. He saw, however, that the Council had been placed in a fix.

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British Gaslight Company.—At the forthcoming meeting of this Company, the Directors will recommend a dividend for the past half year at the rate of 10 per cent. per annum.

Sale of Shares.—Last Friday week, Mr. H. Mundy disposed of 1000 new ordinary shares in the Westbury Gas Company. They were put up in 22 lots, and realized from £10 14s. to £10 18s. per share.

Bangor (Ireland) Water Supply.—An inquiry was held on the 5th inst. at Bangor, by Mr. C. P. Cotton, the Chief Engineering Inspector of the Local Government Board for Ireland, in regard to an application for a loan of £2700 required by the Town Commissioners for improving the water supply of the town. It appeared from the evidence that the size of the distribution-pipes had been found insufficient; and a portion of the town had suffered from want of water. It had consequently been decided to lay an additional 8-inch pipe from the water-works into the town, and to continue it from there by a 5-inch main.

Ottoman Gas Company, Limited.—The report of the Directors of this Company for the half year ended June 30 states that the gas-rental amounted to £8996 (compared with £8599 in the corresponding half of 1897); and the net profit, to £2900. The amount standing at the credit of the profit and loss account is £4438; and the Directors recommend the declaration of a dividend at the rate of 7 per cent. per annum on both classes of shares, which will absorb £2625. The £20,000 of 5 per cent. debentures, which the shareholders authorized the Directors to issue, have been applied for and allotted. Since the last meeting contracts have been entered into for a gasholder and additional mains. The latter are already laid; and it is fully expected that the holder will be completed by the end of November.

The Debt on the Teignmouth Gas-Works.—At a meeting of the Teignmouth District Council last Tuesday, Mr. Wheatley proposed the adoption of the estimate for the new rate of 2s. 6d. in the pound—an advance of 10d. in the pound as compared with the previous rate. He explained that the increase was necessary to pay the outstanding debt of £824 due to Mr. Walker for coal. This amount they were compelled to pay, for they were practically in a state of bankruptcy, and the sooner they got out of it the better. The Auditor required them to charge Mr. Walker's account to the general district rate; and by this means they would extinguish the debt, which had been an encumbrance for many years. A rate of 2s. 6d. in the pound would not entirely clear them; and Mr. Walker and other creditors since March were not provided for. The Chairman (Colonel Morrison) said the Committee had come to a wise conclusion in increasing the rate. They would be able to pay their way now. The resolution was carried. Subsequently on the presentation of the minutes of the Gas Committee recommending the purchase of 2000 tons of coal, the Chairman said that owing to the "pigheaded obstruction" of some members of the Committee, who refused to buy coal at 9s. 9d. a ton, they now had to pay 11s. Mr. Jarvis said it would be "pigheaded" to enter into a contract now at 11s. Coal was bound to drop; and meantime they could buy it as they wanted it. It was eventually agreed to enter into a contract with Mr. Walker for six months.

Kettering Water-Works Purchase Question.—The Kettering District Council last Wednesday considered in private a communication from the Water Company in which, in response to a notice from the Council that they required to purchase the undertaking, they claimed, "as compensation for the purchase money," £175,000, exclusive of the mortgage and other debts of the Company, of compensation to officers, and of the costs and expenses referred to in section 6 (sub-section 3) of the Kettering Water Act, 1898. The Company's terms were discussed at some length; and the opinion was freely expressed that the sum named was excessive. A previous resolution of the Council that the price be fixed by arbitration will now take effect.

Land for Water-Works Extensions at Harrogate.—At a meeting of the Harrogate Town Council last Thursday week, the Water Committee recommended the confirmation of an agreement with Sir Henry D. Ingilby for the acquisition of land at Scargill as the site of a new reservoir. Alderman Fortune, in moving that the Corporation seal be affixed to the agreement, said Sir Henry had been served with notice to treat; and the matter would be submitted to arbitration. It had been arranged, however, that the Corporation should have possession of the site at once, in consideration of their paying 5 per cent. upon what was ultimately decided to be the purchase price. These terms, however, did not include compensation to tenants and damage to farm property. There were only seven or eight tenants to deal with. The motion was carried.

Further Parliamentary Powers for the Shotley Bridge and Consett Gas Company.—The half-yearly meeting of this Company was held on Friday; Mr. George Peile presiding. The Directors reported that the quantity of gas sold in the six months amounted to 25,215,000 cubic feet, which was an increase of 4½ per cent. on the corresponding period of last year. The total expenditure amounted to £3276; and the receipts to £4683—leaving a balance of £1407, which, after providing for interest on loans, would suffice to meet the usual dividends, and carry forward £39. Having mentioned that during the half year 300 prepayment meters had been fixed, the Directors stated that, consequent upon the expenditure necessary for the development of the district, and the introduction of the prepayment meters, the capital had become exhausted; and it was now necessary to obtain further parliamentary powers. For this purpose the Directors had, therefore, resolved to apply to Parliament for additional powers; and they had instructed the Solicitors to take the necessary steps. The report was adopted; and dividends of 5 per cent. on the consolidated stock, 5 per cent. on capital A, and 3½ per cent. on capital B, were declared.

Messrs. W. C. Holmes and Co., of Huddersfield, have secured the contract for the construction of a new gasholder at Hunstanton, tenders for which were invited in our advertising columns on July 19.

Messrs. Richmond and Co. have secured the contract for supplying one of their largest "Holborn" treble cookers, gas hot-closet, and carving table, gas boilers, and other fitting work for the new kitchen of the Vestry of Clerkenwell.

NOW READY.

Foolscap 4to, pp. 535, with 239 Illustrations and Steel-Plate Engraving (as Frontispiece) of WILLIAM MURDOCH, *Inventor of Gas Lighting. Morocco Gilt, 21s.; Roan Gilt, 18s.*

THE SIXTH (AND CENTENARY) EDITION OF THE

HANDBOOK

FOR

GAS ENGINEERS and MANAGERS.

By THOMAS NEWBIGGING, M.Inst.C.E.

This Edition of the "Handbook for Gas Engineers and Managers" is a great improvement on all previous editions. Much of the text has been re-written, in order to keep the work abreast of the constant advances that are being made in the Gas Industry. About fifty additional Illustrations are given; and a Steel-Plate Engraving of William Murdoch, the Inventor of Gas Lighting.

— *PRINCIPAL CONTENTS.* —

Coal; Chief Kinds of Coal; Analyses of Coals and Cannels; Storage of Coal; Spontaneous Ignition of Coal; Gases Occluded in Coal; Testing of Coal for its Producing Qualities; Gas Production; Retort-House; Inclined or Sloping Retorts; Retort-Stack; Retorts; Retort-Settings; Regenerative System of Heating Retorts; Flues and Draught; Analysis of Furnace Gases; Retort-Bench Mountings; Hydrocarbon and other Gases and Vapours; Retort-House Tools and Appliances; Machine Charging and Drawing; Condensation; Naphthalene; Condensers; Exhausters; Steam Engines and Boilers; Washers; Tower Scrubbers; Washer-Scrubbers; Bye-Pass Mains and Valves; Tar and Liquor Wells and Tanks; Purification; Purifying House; Purifiers; Limestones and Lime Burning; Station Meter and other Indicating and Recording Apparatus; Gasholder Tanks; Gasholders; Governors; Main Pipes; Main Pipe Joints; Wrought-Iron and Steel Main-Pipes; Laying of Main-Pipes; Discharge of Gas through Main-Pipes; Service-Pipes and Fittings; Public Lighting; Consumers' Gas-Meters; Testing-Meters; Internal Fittings; Gas Testing Appliances and Methods; Tests for Impurities; Illuminating Power; The Aerorthometer; Foreign and other (proposed) Home Standards of Light; Jet Photometers; Specific Gravity of Gas; Enrichment of Coal Gas; Public Illuminations; Coloured Fires; Illumination Devices; Use of Gas for Purposes other than Lighting; Residual Products; Coal Tar; Ammoniacal Liquor; Sulphur Recovery; Coal Products; Elementary Substances; Chemical and other Memoranda; The Gas Industry; Cost of Gas-Works; Miscellaneous; Bricks and Brickwork; Mortar and Concrete; Iron, Steel, and other Metals; Velocity and Force of the Wind; Office Memoranda; Epitome of Mensuration; Arithmetical and Algebraical Signs; Multipliers; Table of Diameters, Circumferences, Areas of Circles and Sides of Equal Squares; Weights and Measures; French Weights and Measures—Decimal System; Money Tables.

LONDON: WALTER KING, 11, BOLT COURT, FLEET STREET, E.C.

NOTICE TO ADVERTISERS.—COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office *not later* than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of, PERMANENT ADVERTISEMENTS should be received not later than the FIRST POST on SATURDAY.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale than all other Oxides combined. Purity and uniformity of quality guaranteed.
JOHN WM. O'NEILL, Managing Director,
160, 161, & 162, PALMERSTON BUILDINGS,
OLD BROAD STREET,
LONDON, E.C.

ANDREW STEPHENSON, AGENT. All communications re Oxide to the Company as above.

WINKELMANN'S "VOLCANIC" and "VOLCUM" CEMENT. Fire Resistance up to 4500° Fahr. In use in Gas-Works all over the World.
ANDREW STEPHENSON,
182, PALMERSTON BUILDINGS,
OLD BROAD STREET,
LONDON, E.C.
Telegrams: "Volcanism, London."

SULPHATE OF AMMONIA SATURATORS.

JOSEPH TAYLOR & CO., Chemical Plumbers, &c., and Makers of every description of Solid Plate Lead and Timber Cased Saturators, &c., CENTRAL PLUMBING WORKS, TOWN HALL SQUARE, BOLTON. Special attention to Repairs.
Before placing Orders, please write for Estimate.
Telegraphic Address: "SATURATORS, BOLTON."

BROTHERTON & CO.
Offices: Commercial Buildings, LEEDS.
Correspondence invited.

JOHN RILEY & SONS, Chemical Manufacturers, Hapton, near Accrington, are MAKERS of SULPHURIC ACID, from Brimstone, for Sulphate of Ammonia Making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol. References given to Gas Companies.

AMMONIACAL LIQUOR wanted.
BROTHERTON AND CO., Ammonia Distillers.
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

ECONOMY IN PURIFICATION.

INCREASE the efficiency of your PURIFIERS by adopting CRIPPS'S PATENT BYE-PASS VALVE in the lower Tiers of Sieves. Practical Experience proves their Economy. Engineers are repeating orders after thorough trial.
References and Particulars can be obtained from the Makers—
C. & W. WALKER, Midland Iron-Works, Donnington, near Newport, SALOP.

GAS CARBON Wanted, not less than 4-Ton Loads.
Apply to the BRIMINGTON CARBON COMPANY, Sowerby Bridge, YORKS.

SULPHURIC ACID for Sale.
BROTHERTON AND CO., Chemical Manufacturers.
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

J. & J. BRADDOCK (Branch of Meters Limited), Globe Meter Works, OLDHAM.
First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
Telegraphic Address: "Braddock Oldham."

SULPHURIC ACID.

JOHN NICHOLSON & SONS, Limited, Chemical Works, Leeds, specially produce this ACID from SULPHUR, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

PORTER & CO., Gowts Bridge Works, LINCOLN, Engineers, Ironfounders, and Contractors for the erection of Gas-Works for Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings at home and abroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.
Telegraphic Address: "PORTER LINCOLN."
[For Illustrated Advertisement, see Sept. 6, p. 558.]

IMPORTANT.

REPAIR your old Retorts with Patent STICKFAST FIRE CEMENT. Unequalled for Repairing Inclines. Estimates for all kinds of Retort-Settings.
Write CROWTHER, Retort Setter, and Sole Maker of Stickfast Fire Cement, Manor Street, HUDDERSFIELD.

SPENT OXIDE wanted.
BROTHERTON AND CO., Chemical Manufacturers.
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

ENRICH YOUR GAS
WITH
CHEAP BENZOL.
AT to-day's Price of Benzol, Illuminating POWER cost less than a HALFPENNY PER CANDLE.
Apply to SADLER AND CO., MIDDLESBROUGH.

PATENTS FOR INVENTIONS.

J. C. CHAPMAN, M.I.M.E., and Fel. Chartered Inst. Patent Agents. ADVICE ON ALL MATTERS CONNECTED WITH ABOVE.
Information and Handbook on application.
70, CHANCERY LANE, LONDON, W.C.

TO GAS AND WATER OFFICIALS.

SPECIALLY favourable terms for Cycles. First-Class Workmanship and Material guaranteed. Art Catalogue post free.
MELROSE CYCLE COMPANY, COVENTRY.

HYDRATED OXIDE OF IRON.

PREPARED from pure Iron.
Two or three times as rich as Bog Ore.
Strong action on Sulphuretted Hydrogen.
To be used alone, but will increase activity of other Oxides.
Less than half the price of Bog Ore.
Can be lent on hire.
Write for tabulated results.
READ HOLLIDAY AND SONS, LIMITED, HUDDERSFIELD.

GAS PURIFICATION.

OXIDE OF IRON BOG ORE.

BALE & CO.'S Oxide of uniform quality. SPECIAL FIRE CEMENT, OXIDE PAINTS, OILS, SULPHURIC ACID, &c.
120 and 121, NEWGATE STREET, LONDON, E.C.
Telegrams: "BOGORE, LONDON."

GAS TAR wanted.
BROTHERTON AND CO., Tar Distillers.
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

SPECIAL PAINT FOR GAS-WORKS.

JOHN E. WILLIAMS AND CO.,
VICTORIA PAINT WORKS,
MANCHESTER.
Telegrams: "ENAMEL." National Telephone 1769.

SADLER & CO., Ld., Middlesbrough; ULVERSTON (BARROW); PORTSMOUTH; CARLTON (N.E.R.); and STOCKTON. Tar and Petroleum Distillers. Benzol and Petroleum Spirit, 700 and other Gravities specially prepared for Carburetting. SOLAR OIL for Gas Making, Kerosene, &c.
Correspondence invited.
Telegraphic Address: "SADLER, MIDDLESBROUGH."

CANNEL, COAL, ETC.

JOHN ROMANS & SON, EDINBURGH, Gas Engineers, supply all the most approved SCOTTISH CANNELS; also FIRE-CLAY GOODS, CAST-IRON PIPES, and other APPARATUS for GAS and WATER WORKS.
Prices, &c., will be forwarded on application to
No. 30, ST. ANDREW SQUARE, EDINBURGH, } SCOTLAND.
NEWTON GRANGE, NEWBATTLE, DALKEITH, }

CHANGE OF ADDRESS.

MR. F. S. CRIPPS, Consulting Gas and Water Engineer, has the pleasure to announce that he has OPENED OFFICES at 71, KING WILLIAM STREET, LONDON, E.C.

THOROUGHLY qualified and experienced ENGINEER and MANAGER desires similar appointment, with or without Secretarial duties. Highest references. Satisfactory reasons for changing.
Address No. 3114, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Situation as Meter INSPECTOR or FITTER. Thoroughly Experienced in Automatic Meters, Stoves, and Fires. Good Testimonials.
Address No. 3130, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

SITUATION wanted by practical Man as OUTDOOR INSPECTOR or FOREMAN of Fitters, or to take Charge of Branch Depôt or Stove Department. Well up in Mains, Services, Meters, Automatic Fittings, and Incandescent Lighting.
Address F. R., 5, Folkestone Road, West Ham, Stratford, ESSEX.

WANTED, an experienced Young Man as DRAUGHTSMAN. Must be well up in Gasholders and General Constructional Ironwork, both as regards Estimating and Drawings.
Address No. 3128, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

GWYNNE & BEALE'S
PATENT
GAS-EXHAUSTERS AND STEAM-ENGINES
FOR FULL PARTICULARS, APPLY TO THE MAKERS:
GWYNNE & CO.,
Telegrams: "GWYNNEGRAM, LONDON."
HYDRAULIC AND GAS ENGINEERS
(Late Essex Street Works, Victoria Embankment, London),
Telephone No. 95 Holborn.
BROOKE STREET WORKS, HOLBORN, LONDON, E.C.

WANTED, by a thoroughly qualified Man, employment either as FOREMAN of DISTRIBUTION DEPARTMENT, CHIEF INSPECTOR, or SUB-CONTRACTOR for laying Mains and Services, Fitting up Houses on the Slot or Ordinary System, Repairing and Fitting Stoves, checking Indices, &c. Age 40 Years; 25 Years' practical Experience. Used to the Testing-Room.

Address 20, Ellacombe Church Road, Torquay, DEVON.

GAS-FITTER wanted, well up in Iron and Compo. Must be a steady and reliable Man. Apply to the GAS COMPANY, Cradley Heath, STAFFS.

WANTED, two or three good Men for SERVICE LAYING.

Apply, stating Experience and Wages required, to Mr. COLES, Gas Offices, PLYMOUTH.

DRAUGHTSMAN wanted by Civil Engineer in City. Must have had good experience in Gas Contractor's Office.

Apply, by letter, stating full Particulars, to No. 3127, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

YORK WATER-WORKS COMPANY.

WANTED, a Secretary and City MANAGER. One having had previous experience in a Water-Works Office preferred. Salary £300 a Year, with House.

Applications, with not more than three Testimonials, to be forwarded by the 21st of September inst, addressed to the DIRECTORS of the YORK WATER-WORKS COMPANY, Lendal Hill, YORK.

TORQUAY GAS COMPANY.

WANTED, at once, a Working Foreman for Outdoor Department. Must be well up in Main and Service Laying and Gas-Fitting. Competent to take charge of and direct Workmen. House Rent free.

Apply stating Age, Qualifications, References, and Wages required to

ROBERT BEYNON,
Engineer and Manager.

Gas-Works, Hollacombe, Paignton.

MERTHYR TYDFIL GAS COMPANY.

WANTED, a competent young Man as INSPECTOR OF METERS and ASSISTANT CLERK in the Gas-Fittings Department. Wages, 25s. per week.

Applications, in own handwriting, stating Age, where last employed, and enclosing *copies* only of three recent Testimonials as to Character, &c, to be addressed to the undersigned not later than Wednesday, the 5th of October prox.

JOHN L. COCKER,
Secretary and General Manager.

Gas Office and Works, Merthyr Tydfil,
Glamorganshire, Sept. 10, 1898.

MERTHYR TYDFIL GAS COMPANY.

WANTED, a competent Man to repair and test Wet and Dry Gas-Meters. Wages, 30s. per week.

Applications, stating Age, where last employed, with References as to Character and Experience, to be addressed to the undersigned not later than Friday, the 30th inst.

JOHN L. COCKER,
Secretary and General Manager.

Gas Office and Works, Merthyr Tydfil,
Glamorganshire, Sept. 10, 1898.

WANTED, Carbon in 4 Ton Lots, or more; also OIL CARBON.

State Price, f.o.r. at nearest Station, to No. 3031, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

GASHOLDER, 35 feet diameter by 14 feet deep, with five strong Cast Columns, Wrought Lattice Girders, and Counterbalance. Erected 1892. Cheap, if sold immediately.

J. F. BLAKELEY, Ravensthorpe, near DEWSBURY.

FOR SALE, Cheap—One (nearly new) 4800 cubic feet per hour STATION METER; and two 6-inch STATION GOVERNORS.

Apply, by letter, to No. 3129, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. **Compare Prices and Particulars before ordering elsewhere.**

J. F. BLAKELEY, Gas Engineer, Ravensthorpe, YORKS.

CONTRACT FOR GASHOLDER.

THE Directors of the Eastbourne Gas Company are prepared to receive TENDERS for the construction at their Works of a GASHOLDER, 158 ft. by 90 ft., to be in accordance with the Drawings and Specification which may be seen at the Office of the Company at Eastbourne, and of which Copies and detailed Particulars may be obtained on application to the Engineer, Mr. H. E. Jones, Gas-Works, Harford Street, Stepney.

Sealed Tenders, marked on the outside, to be delivered to me by Wednesday, the 28th of September, 1898.

The person whose Tender is accepted will be required to enter into a Contract for the due performance of the Work, and to give such Security as the Directors shall require, such Contract and Security to be prepared by the Solicitors of the Company, at the expense of the Contractor.

The Directors will not be bound to accept the lowest or any Tender.

(Signed) J. H. CAMPION COLES,
Secretary.

CARLUKE GAS COMPANY, LIMITED.

OWING to the Erection of New Works, the above Company have FOR DISPOSAL the whole GAS PLANT situated at their present Works, including Retort-Bench Mountings, Condensers, Tar-Tanks, Purifiers, Governor, Station Meter (almost new), Two Gasholders, 30 ft. by 12 ft. and 35 ft. by 12 ft. respectively. Delivery may be given by the 15th of October.

For Particulars, apply to the Secretary, who will receive offers for the whole, or part, up till the 30th of September.

JAS. J. WILSON,
Secretary.

Gas-Works, Carluke, Scotland,
Aug. 30, 1898.

BOROUGH OF EVESHAM.
(GAS DEPARTMENT.)

TENDERS FOR CAST-IRON MAINS.

THE Corporation invite Tenders for the supply of 6-inch CAST-IRON MAINS.

For Further Particulars, apply to the undersigned.

The Corporation do not bind themselves to accept the lowest or any Tender.

PERCY H. FLETCHER,
Engineer.

Gas-Works, Evesham,
Sept. 12, 1898

BARNOLDSWICK URBAN DISTRICT COUNCIL.
(GAS DEPARTMENT.)

THE Council are prepared to receive TENDERS for the supply of 1000 Tons of best screened GAS COAL (to be delivered at Barnoldswick Station, Midland Railway) for the Year ending Aug. 31, 1899.

The Council will reserve the option of purchasing the whole or part of the quantity named.

Tenders to be sent in not later than Wednesday, Sept. 21, 1898, addressed to the Chairman of the Gas Committee, and endorsed "Tender for Gas Coal."

The lowest or any Tender not necessarily accepted.

D. E. GARLICK,
Manager.

LEIGH URBAN DISTRICT COUNCIL,
(GAS AND WATER DEPARTMENTS.)

THE Gas and Water Committee invite TENDERS for the supply of 3, 4, and 6 inch CAST-IRON SOCKET and SPIGOT PIPES.

Forms of Tender and further Particulars can be obtained on application to the Engineer, Mr. J. Foster.

Sealed Tenders, endorsed "Tender for Pipes," and addressed to me, the undersigned, on or before Twelve o'clock noon, on Monday, the 19th day of September, 1898.

By order,
PEREGRINE THOMAS,
Clerk to the Council.

Town Hall, Leigh, Lancs.,
Sept. 7, 1898.

CITY OF BELFAST.

CONTRACT FOR COAL.

THE Gas Committee of the Belfast Corporation invite TENDERS for a supply of 90,000 Tons of best screened GAS COAL, to be delivered free and trimmed in Barges at Belfast Harbour, between Oct. 1, 1898, and Sept. 30, 1899.

No Tender for less than 10,000 Tons will be considered.

Monthly Quantities and Particulars may be obtained from the Manager of the Gas-Works.

Tenders, on Office Forms, endorsed "Tender for Coal," should be delivered at my Office not later than the 29th of September.

The lowest or any Tender not necessarily accepted.

SAMUEL BLACK,
Town Clerk.

TO CONTRACTORS.

GASHOLDER TANK.

THE Edinburgh and Leith Corporations' Gas Commissioners are prepared to receive TENDERS for the EXCAVATORS', CONCRETORS', BRICKLAYERS', and MASONS' WORK in connection with the construction of a BRICK and PUDDLE GASHOLDER TANK, 252 ft. 6 in. diameter by 37 feet deep at their New Works at Granton, near Edinburgh.

Specification and Schedule of Quantities may be obtained on application to the Engineer, Mr. W. R. Herring, on payment of a sum of £5, which will be returned on receipt of a *bonâ-fide* Tender. The Drawings and Sections may be inspected, and any further Information obtained upon application to the Engineer at his Office, New Street, Edinburgh.

Tenders are to be lodged by Ten a.m. on the morning of the 17th day of October, endorsed "Tender for Gasholder Tank," and addressed to the undersigned.

The Commissioners do not bind themselves to accept the lowest or any Tender.

JAMES M'G. JACK,
Clerk to the Gas Commissioners.

25, Waterloo Place, Edinburgh.

OTTOMAN GAS COMPANY, LIMITED.

NOTICE is Hereby Given, that the ORDINARY HALF-YEARLY GENERAL MEETING of the Shareholders of this Company will be held at 9, Queen Street Place, Cannon Street, E.C., on Tuesday, Sept. 20, 1898, at Half-past One o'clock precisely, to receive the Report of the Directors and Statement of Accounts for the Half Year ended the 30th of June last, to declare a Dividend, and for General Purposes.

The TRANSFER BOOKS WILL BE CLOSED from Sept. 13 to 20, both days inclusive.

By order of the Board,
THOMAS GUYATT,
Secretary.

9, Queen Street Place, Cannon Street,
London, E.C., Sept. 6, 1898.

ITCHEN URBAN DISTRICT COUNCIL.

THE above-named Council invite TENDERS for the supply of 150 (more or less) CAST-IRON LAMP COLUMNS and LANTERNS complete. Price per Column and Price per Lantern (either Copper or best Tin Frames), to be delivered, carriage paid, to Woolston Station (near Southampton).

Drawings of Columns and Lanterns to be furnished with Particulars as to weight of Column, and stating the earliest date at which delivery can be made.

Further Particulars may be obtained on application to Mr. T. A. Collingwood, the Council's Surveyor, at his Office, Bridge Road, Woolston.

Tenders, sealed and endorsed "Tenders for Columns and Lanterns," to be sent to me the undersigned on or before Tuesday, the 20th inst.

The Council do not bind themselves to accept the lowest or any other Tender.

W. HENRY BELL,
Clerk to the Council.

Woolston, near Southampton,
Sept. 9, 1898.

COMMERCIAL GAS COMPANY.

NOTICE is Hereby Given, that an ORDINARY MEETING of the Commercial Gas Company will be holden at the Cannon Street Hotel, in the City of London, on Thursday, the 6th of October, 1898, at Twelve o'clock at Noon, to receive the Directors' Report and the Accounts of the Company for the Half Year ended the 30th of June, 1898, to declare a Dividend, and to authorize the raising of additional Capital.

The STOCK TRANSFER BOOKS WILL BE CLOSED from the 23rd of September inst. to the 6th of October next, both days inclusive.

By order of the Board,
H. D. ELLIS,
Secretary.

Offices: Stepney,
Sept. 10, 1898.

EAST LONDON WATER-WORKS COMPANY.

NOTICE is Hereby Given, that the HALF-YEARLY ASSEMBLY of Proprietors will be held at the Company's Offices, St. Helen's Place, Bishopsgate Street, E.C., on Thursday, the 6th of October, 1898, at Twelve o'clock noon precisely, pursuant to Act of Parliament.

The TRANSFER BOOKS in respect of the ORDINARY STOCK WILL BE CLOSED from the 22nd of September inst. to the 12th of October inclusive, and RE-OPENED on the 13th of October, on which day the Dividends on this Stock will be payable.

By order,
I. A. CROOKENDEN,
Secretary.

St. Helen's Place,
Bishopsgate, E.C., Sept. 7, 1898.

BRITISH GASLIGHT COMPANY, LIMITED.

NOTICE is Hereby Given, that the ORDINARY HALF-YEARLY GENERAL MEETING of the Proprietors of this Company will be held at this Office on Wednesday, the 28th inst., at Half-past Twelve o'clock precisely, to transact the usual Business, to declare a Dividend for the Half Year ended the 30th of June last, and to elect two Directors and one Auditor in place of those who go out by rotation, but who are eligible to be re-elected.

Notice is Hereby also Given, that the TRANSFER BOOKS of the Company WILL BE CLOSED on the 17th inst, and RE-OPENED on the 29th inst.

By order of the Court of Directors,
H. B. CHAMBERLAIN,
Secretary.

Chief Office: No. 11, George Yard,
Lombard Street, London, E.C.,
Sept. 7, 1898.

KING'S LYNN GAS COMPANY.

Issue of £1000 PREFERENCE FOUR PER CENT STOCK, under the King's Lynn Gas Order, 1888, confirmed by the Gas Orders Confirmation (No. 2) Act, 1888, and £6400 PREFERENCE FOUR PER CENT. STOCK, under the King's Lynn Gas Order, 1898, confirmed by the Gas Orders Confirmation (No. 1) Act, 1898.

NOTICE is Hereby Given, that, on the 8th of October, 1898, the Directors will receive TENDERS for the purchase of the ABOVE STOCK in 74 Lots of £100 each.

Printed Conditions and Forms of Tender may be had on application, by post or otherwise, to the Manager, Gas-Works, King's Lynn, or to the undersigned.

By order,
J. J. COULTON
F. H. PARTRIDGE } Clerks.

King's Lynn, Sept. 6, 1898.

SALES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS begs to notify that his AUCTIONS of STOCKS and SHARES in London, Suburban, and Provincial Gas and Water Companies are held MONTHLY, at the Mart, Tokenhouse Yard, E.C.

He also undertakes the issuing by Auction of Gas and Water Stocks and Shares under Parliamentary Powers.

Terms for issuing such Capital, and also for including Gas and Water Stocks and Shares in these periodical Sales, can be obtained on application at Mr. Alfred Richards's Offices, 18, FINSBURY CIRCUS, E.C.

THOMAS DUXBURY & CO.,
16, DEANSGATE, MANCHESTER.

GAS ENGINEERS' AGENTS AND CONTRACTORS FOR

Meters, Fire-Clay Goods, Oxide of Iron, and all other Gas Apparatus. Retort Carbon purchased.

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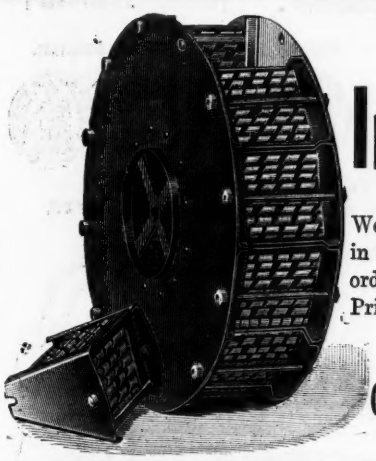

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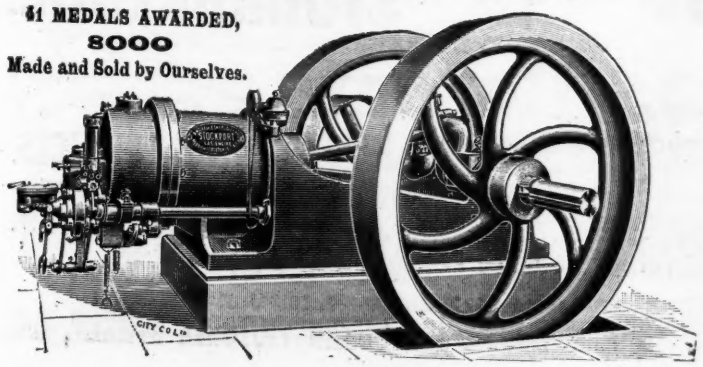

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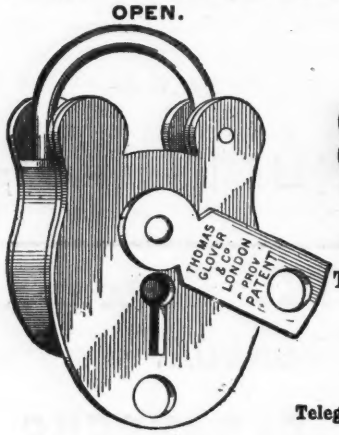

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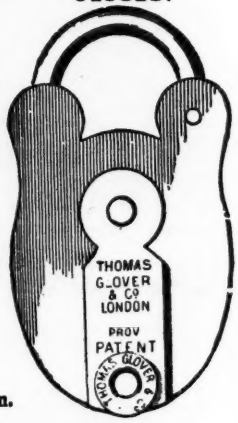

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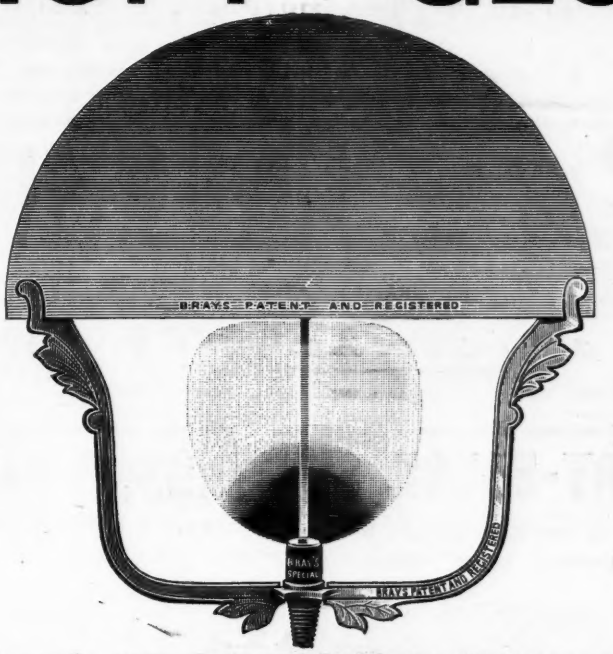

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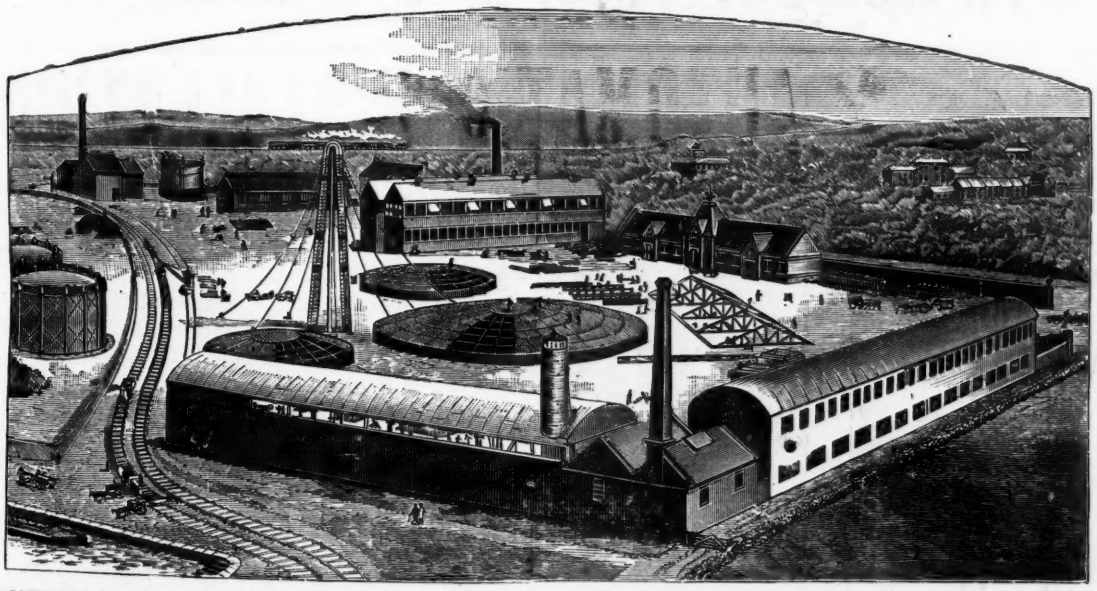

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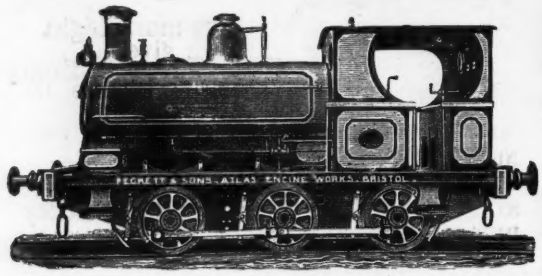

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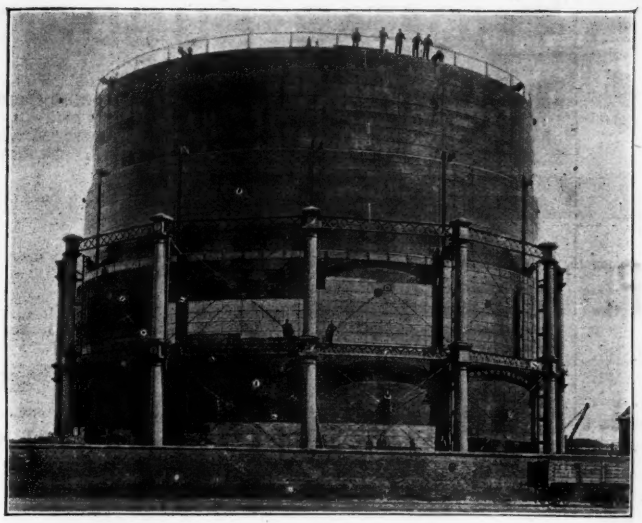

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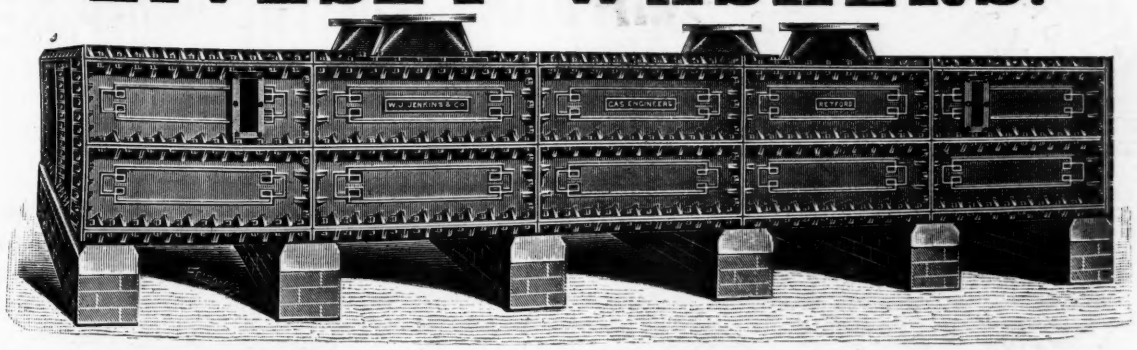

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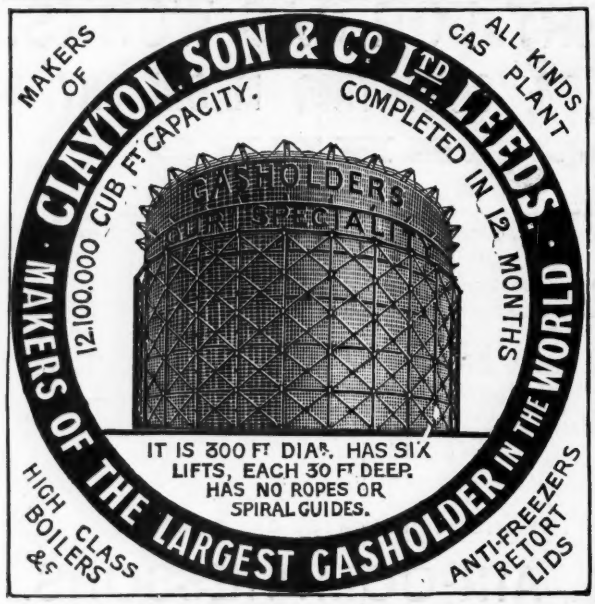
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[See Illustrated Advertisement, Sept. 6, p. 559.]

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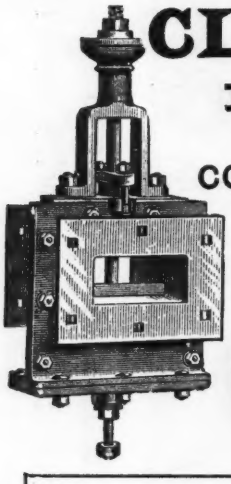

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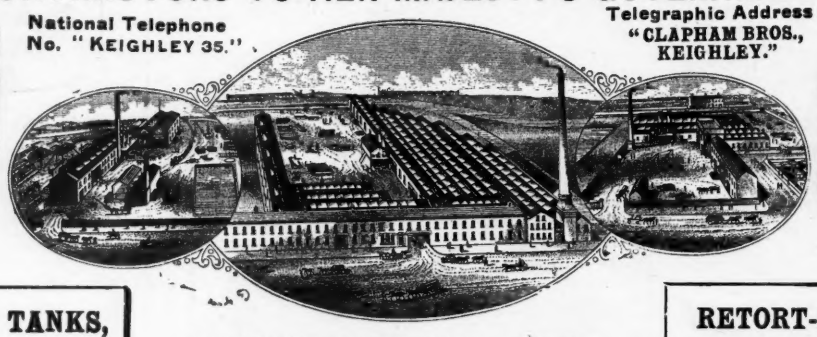

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